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ADVENTURES IN RADIATION

Finding New Uses for Ultraviolet

BY DONALD C. STOCKBARGER

IN the Philosophical Transactions of the Royal Society dated 1672 there appeared a letter to the editor from Isaac Newton, then Professor of Mathematics in the University of Cambridge:

"Sir, — To perform my late promise to you, I shall without further ceremony acquaint you, that in the beginning of the year 1666 (at which time I applied myself to the grinding of optic glasses of other figures than spherical) I procured a triangular glass prism, to try therewith the celebrated phaenomena of colours. And for that purpose having darkened my chamber, and made a small hole in my window shuts, to let in a convenient quantity of the sun's light, I placed my prism at his entrance, that it might be thereby refracted to the opposite wall. It was at first a very pleasing diversion to view the vivid and intense colours produced thereby; but after a while applying myself to consider them more circumspectly, I was surprised to see them in an oblong form; which according to the received laws of refraction, I expected would have been circular. . . .

"As the rays of light differ in degrees of refrangibility, so they also differ in their disposition to exhibit this or that particular colour. Colours are not qualifications of light, derived from refractions, or reflections of natural bodies (as it is generally believed) but original and connate properties which in divers rays are diverse. Some rays are disposed to exhibit a red colour, and no other; some a yellow, and no other; some a green, and no other, and so of the rest. . . .

"The species of colour, and degree of refrangibility proper to any particular sort of rays, is not mutable by refraction, nor by reflection from natural bodies, nor by any other cause, that I could yet observe. When any one sort of rays has been well parted from those of other kinds, it has afterwards obstinately retained its colour, notwithstanding my utmost endeavors to change it. . . ."

Davis

IN THE RADIATION LABORATORY: HIGH FREQUENCY ELECTRODELESS DISCHARGE IN MERCURY VAPOR

Newton's discovery of the visible spectrum marked the real beginning of scientific investigation of radiation. The infrared and ultraviolet spectra were discovered almost simultaneously early in the Nineteenth Century by Herschel and Ritter, respectively. History tells us, however, that the effects of sunlight on the human body and on certain chemicals were recognized centuries before the discoveries of the spectra. Yet with all of the knowledge which had accumulated, no great progress was made in phototherapy and photochemistry until the invention of the powerful sources of ultraviolet late in the Nineteenth Century. These inventions

Davis

FLUORESCENCE OF BOTTLED SOLUTIONS ACTIVATED BY ULTRAVIOLET

opened up very large fields of usefulness for radiation and stimulated new research in many of the university and commercial laboratories throughout the civilized world.

The time came when the investigators realized that their knowledge of photochemical and phototherapeutic reactions was getting far ahead of their understanding of radiation itself, and therefore a new chapter of history dealing with the development of methods of measuring radiation was begun by such men as Boys, Paschen, Tyndall, and Rubens. But in spite of the need of the new knowledge, advance in this direction has not been rapid because relatively few men have had either the facilities or the training necessary for the performance of such delicate work as that which is encountered in radiation measurements.

Nearly ten years ago the Cooper Hewitt Electric Company suggested to a member of the Institute staff that a valuable research problem would be a study of the quartz mercury arc lamp, a device now well enough known so that no description of it is necessary. In common with many radiation sources this emits not only a certain amount of light but also some heat rays, known as infrared, and other invisible rays known as ultraviolet. The problem was to analyze the radiation, *i.e.*, separate the different kinds of rays and measure the quantity of each. Today that would be looked upon as a relatively simple task, but ten years ago practically no suitable apparatus was to be found in any of the Institute laboratories. It was necessary to build most of the equipment and to work out special procedures with the aid of the scattered writings of the few men who had undertaken similar work before that time. The publications of Dr. Coblentz of the United States Bureau of Standards were particularly helpful. The results of those early tests in the new laboratory are not recalled with pride, for they were full of inaccuracies, but nevertheless some results were obtained and the Cooper Hewitt Electric Company saw enough possibilities in the future to warrant contributing a considerable amount of money and some excellent equipment for the founding of a radiation measurements laboratory.

The early location was merely a small corner in the Electrochemical Laboratory. There, many hours, day and night, were spent separating and measuring invisible rays much as chemists analyze foods, drugs, and the like. Then other radiation problems were suggested by various industries for the laboratory to study. These called for additional equipment so that within a few years lack of space was a real handicap. The little laboratory would have burst had not something happened.

That something was official recognition in 1927 that radiation measurements was a suitable subject of instruction. It was felt that if industry was calling for help in solving radiation problems, then industry should be supplied with men trained to handle the work. Fortunate it was for the laboratory, therefore, that a moving day arrived and most of the apparatus was transferred to roomier quarters where several students and several members of the staff could work. Fortunate it was again that when the new room likewise became too crowded the present much larger space was found.

Here men are taught the theory of radiation measurements and are given ample opportunity to learn something concerning the art of putting the theory into practice. Undirected they would have to spend years to fit themselves to undertake the research problems which come to the laboratory almost weekly, for books on the subject are difficult to find.

The problems presented for study are not only numerous but varied in character. They have to do with the manufacture of such things as cloth, paper, rubber, leather, tin cans, glass, arc lamps, incandescent lamps, varnish, ink, chemicals, fire alarm boxes, and photoelectric cells; they pertain to questions of health, safety, communication, television and even magic. It may seem strange that a comparatively new laboratory should have so many different contacts with industry, and that such mysterious looking experiments as are in progress should have commonplace, practical applications. This is so, partly because the laboratory places particular emphasis on the

Davis

APPARATUS FOR DETERMINING INTENSITY OF RAYS (VITAL RAYS) KNOWN TO CURE RICKETS

Davis

APPARATUS FOR STUDYING THE EFFECT OF BOMBARDING GAS ATOMS WITH HIGH SPEED ELECTRONS. SEE PAGE 188

study of ultraviolet radiation which has found a place of increasing importance in everyday life. It is so also because the laboratory has expanded the scope of its field to include practical applications of radiation.

In one section of the laboratory a dozen or more strips of paper hang from a line like so many pieces of a Monday morning washing. Nearby is a peculiar looking lamp whose rays impart to the strips a greenish color. The manufacturer of the paper samples, which are representative of materials designed for use on milady's writing desk, has noticed that some of these become discolored when exposed to sunlight. He requested the laboratory to coöperate with him in his efforts to improve his products by exposing them to different kinds of radiation, preliminary to making color and folding tests in his own plant.

In another section might be found a row of tin cans freshly painted in gay colors being exposed to a powerful source of ultraviolet radiation. From time to time an attendant examines the painted surfaces to determine which ones have become dry enough to handle. After the paint has become thoroughly dry further tests will be made to find out whether the surfaces have become dull and whether any small cracks or blisters have appeared. This is illustrative of a fairly large class of investigations on rapid drying of paints and varnishes. It has been found that the time required to produce a thoroughly dried surface can often be reduced from hours or days to a few minutes. Sometimes the process goes along smoothly and satisfactorily but in the case of certain materials the final result is imperfect. It is the laboratory's job to make a comprehensive study of the matter so as to be able to specify what kind of a lamp to use as a source of ultraviolet and how much it is safe to reduce the time of drying from that which would be normal under natural conditions.

Davis

PORTRAIT OF AUTHOR MADE BY ULTRAVIOLET LIGHT IN A DARK ROOM

Immediately upon entering the laboratory one detects the odor of ozone. It is a smell not unlike that of freshly washed clothes which have been allowed to dry out in the open. This gas, formed from oxygen, is being generated by the ultraviolet rays from a quartz mercury arc situated at the end of a large table and surrounded by a heavy black cloth in order to protect the skin and eyes of the man who is testing it. An analysis of the rays is being made so that a report can be issued to the owner of the arc, who uses it to give daily treatments for rickets to a small colony of white rats. It has been known for several years that rickets can be cured by exposure to certain kinds of ultraviolet radiation and it is to make a closer study of the matter that the biologist who owns the arc is carefully measuring out the quantities of the rays which he gives his small patients. Without such an analysis as is being made he would not

know how long to leave the rats under the arc. After he has completed the rat experiments he will give his findings to the medical world where they will be of great value in the treatment of rickets in children.

At another table sits a man with a pile of small squares of glass (see adjacent illustration). These he inserts in a complicated looking instrument meanwhile gazing intently through the eye piece of a telescope. What he sees is the scale of a very delicate electrical measuring instrument which tells him how efficient the little square of glass is in transmitting certain kinds of radiation. When he has finished his task he will be in a position to advise the manufacturer of the glass whether or not his product is exceptionally well adapted for glazing — greenhouses, perhaps. Several months ago similar tests were made on pieces of glass which had been removed from the solarium of a hospital. The authorities in charge of that institution had heard a rumor that the special glasses for transmitting the ultraviolet of sunlight had a tendency to lose their effectiveness after a few months of use. It is of general interest that the tests showed conclusively that such was not true. To be sure the glasses were not quite as efficient as when they had first been installed in the solarium but they were still in excellent condition and would remain so until they were broken. Naturally the authorities were very pleased to obtain the information and to be assured that the installation of the windows had not been a mistake. "Ultraviolet transmitting" glass might be compared with a gold ring which, although it soon loses its original high luster, nevertheless retains its color and its value until it is worn out. These glasses lose a little of their efficiency very quickly after they are installed but the change is not a serious one and it stops soon after it has begun.

Davis

MEASURING THE INFRARED TRANSMISSION PROPERTIES OF GLASS. SEE TEXT ABOVE

Prior to one of the moving days the main storage cabinet was cluttered with a pile of small wooden panels some of which looked as though they had been freshly varnished and others as though they had gone through a fire. A few of them had surfaces which might have reminded one of a rare old violin. Someone submitted the panels with the hope that by exposing them to the proper kind of radiation they could be made to take on the mellowness of age. There are tricks in the manufacture of all kinds of things including "antique" furniture!

At one time a small table quite heavily loaded with beakers, flasks, test tubes, and bottles occupied an important place in the laboratory. In and among the flasks ran such a maze of glass and rubber tubing that the whole looked like part of a chemical laboratory. In the midst of that conglomeration of glassware was a tiny lamp whose feeble red light was hardly discernible at a distance. It was such a strange outfit for a physical laboratory to be using that visitors regularly stopped to ask questions. And after receiving an answer they would almost invariably go away shaking their heads, for they were told that an attempt was being made to synthesize a chemical compound containing neon. Most people consider neon to be inert and consequently incapable of uniting with other elements. A discussion of the outcome of the particular experiment has no place here but it is relevant to add that there are a great many chemical reactions which cannot proceed without the help of some kind of radiation, and that the laboratory is often called upon to find out what kind of radiation is most suitable and how efficiently it is able to promote a certain reaction.

On a shelf-like bench fastened to one of the walls is a piece of apparatus which resembles an overgrown radio tube. Facing it is a peculiar kind of camera and over the two is thrown a heavy black cloth to exclude the light while a photograph is being taken. While it is rather unusual to take pictures in the dark, it is nevertheless possible when ultraviolet radiation is present. Actually in this case, however, the big vacuum tube is not posing for its portrait but a photograph is being made of the spectrum of a faint beam of invisible radiation sent out by it. This radiation is so weak that exposures of one to twelve hours are usually necessary in order to obtain a good picture.

Not long ago the laboratory was asked to make ultraviolet photographs of some bank records which were a part of a court exhibit. As is well known, such photographs of altered documents have an advantage over ordinary ones in that the details of the original writing or printing can often be seen. Occasionally human portraits are made in a similar manner but ordinarily they possess no particular value other than that which arises from the uniqueness of the circumstances under which they were made. In some cases, however, abnormal skin conditions otherwise unsuspected are made evident and this fact is becoming of some importance to the diagnostician. Besides the practical problems which are attacked, there are as many which are purely scientific. One example will suffice. A long-time study is being made of the effect of bombarding gas atoms with high speed electrons. In general, radiation is known to result from the collisions, but some of the laws governing the process are still obscure. When those laws are found, a better picture of the atom can be drawn. And with that picture, the physicist will be better able to solve practical problems concerning atoms, such as how to make a more efficient source of useful radiation. It may sound like dry, uninteresting work, but in reality that is not true. Even the apparatus, (*Continued on page 210*)

Juley

"ENGINEERING," A MURAL BY FRED DANA MARSH IN THE LIBRARY OF THE ENGINEERING SOCIETIES, NEW YORK

BUILDING A GREAT CITY

The Engineer's Contribution to Metropolitan Boston

By Frederic H. Fay

WITHIN the present generation new and increased facilities for local transportation have enabled the population from the more thickly settled districts of our larger cities to spread out over adjacent and more open suburban territory. In its more recent decennial enumerations of population of the country, the United States Bureau of the Census has taken cognizance of this dispersion of population of our large cities. The Bureau recognizes that in many cases the number of inhabitants enumerated within city boundaries gives an inadequate idea of the population grouped about one urban center.

"In fact, in only a few of the large cities do the municipal boundaries closely define the urban areas. Immediately beyond the political limits of many cities, and connected with them by rapid transportation systems, are densely populated suburban districts which industrially and socially are parts of the cities themselves, differing only in the matter of governmental organization." * For this reason the Bureau of the Census, in the case of each city having 200,000 inhabitants or more, has delimited what it terms the "Metropolitan District," which includes, in addition to the city itself, those sections of the adjacent territory which are considered urban in character.

The rapid growth of population of suburban territory has affected different cities in different ways. In most cases it has resulted in the territorial growth of the cities themselves by annexation. Chicago is an example of a city which has grown in area nearly as rapidly as the growth in population of the urban district of which it is the center. In 1920, eighty-five per cent of the entire population of the Chicago Metropolitan District was found within the city limits, and today it is probable that the city contains more then eighty per cent of the population of its metropolitan area.

Boston and Pittsburgh, on the other hand, are examples of cities which have not grown in area with the growth of population of their metropolitan districts. These two cities today are the only two in the country in which the population residing within the city limits is less than half that of the metropolitan district. In Pittsburgh this situation is of comparatively recent development. In Boston, however, it is one of long standing and for fifty years and more the population of the outside territory of the Boston Metropolitan District has outnumbered that within the Boston city limits.

For more than half a century the Boston district has maintained the position which it holds today, that of the fourth largest urban district of the country, being exceeded only by New York, Chicago, and Philadelphia. Boston, of all our large cities, was the first to develop as the center of an important metropolitan territory and the Boston Metropolitan District, therefore, was the pioneer metropolitan district of the country.

It is the purpose of this article to deal historically with the development of conditions which, of necessity, finally led to united action by Boston and certain other communities on matters of common welfare, and to describe the metropolitan agencies established by the Commonwealth of Massachusetts for meeting these needs.

BOSTON was first settled in 1630; the original town being located on a small peninsula, almost an island, connected with the mainland by a narrow neck. Beacon Hill, on which the State House stands, was the central eminence of this small natural peninsula, which lay to the east of present Charles Street and Broadway, within what is now known as the down-town business section and the

* Fourteenth Census of the U.S., 1920, Vol. I, page 62.

Ewing Galloway

THE GREAT LOS ANGELES SYPHON, SUPPLYING THE CITY WITH WATER

North End. Topographically, the city has undergone radical changes. Most of the original small hills have been leveled. Beginning early in the last century the need for increased area for the town was met by filling the flats along the shore frontage, notably in the Back Bay, until today not one foot of Boston's original shore line remains.

When the first sewer was built is not known but it was earlier than the year 1700, for in 1701, when the population was about 8,000, the nuisance created by frequent digging up of streets to lay new sewers and to repair those previously built had become so great as to lead to the passage of a regulatory ordinance at a Town Meeting. Up to this time, and in fact for a century and a quarter thereafter until Boston had been incorporated as a city, all sewers were built by private enterprise.

The filling of the flats along the shore frontage necessitated the extension of the old private sewers whose outlets would have been cut off. The extensions in the filled areas were built with little or no slope, and in some cases the sewers actually ran up hill. The shore outlets were almost invariably below high tide level and were provided with tide-gates. As a consequence, the contents of the sewers were dammed back by the tide during the greater part of each twelve hours.

THE Massachusetts Board of Health, the first state board in the country, was established by legislative enactment in 1868. While it had state-wide jurisdiction, the principal reason for its creation was the insanitary condition resulting from the concentration of population in the drainage basin in and around Boston. The State Board of Health early considered, and urged action upon, the drainage problem of Boston and its immediate surroundings.

Spurred to action by the City Board of Health, Boston set up a municipal commission in 1875 to study the drainage problem. The report of this commission recommended two systems of main and branch intercepting sewers, serving territories on both sides of the Charles River. The northerly system, which was to serve not only the Charlestown and East Boston sections of Boston but also portions of Cambridge, Somerville, Everett, Chelsea, and Winthrop, was not adopted at the time because of the failure of Boston to secure the voluntary coöperation of the other communities in which much of this system lay. The southerly system, planned to serve the city proper and parts of Brookline and of the Roxbury, Dorchester, and South Boston sections of Boston, lay almost entirely within the limits of Boston and was substantially that built immediately thereafter.

Having secured the necessary legislative authorization, the city built the Boston Main Drainage System between 1876 and 1885. It consists of intercepting sewers along the waterfronts of the city proper and South Boston, connected with, and taking all flow, other than heavy storm flow, from the old sewers which formerly had discharged directly into tidewater all along these waterfronts. These intercepting sewers connect with the main sewer leading to the main Drainage Pumping Station at Calf Pasture on the shore of Dorchester Bay. Sewage is received at this pumping station at a level from eleven feet to fourteen feet below low water; it is lifted by pumping about thirty-five feet; it is then carried under pressure through a tunnel or inverted siphon beneath Dorchester Bay to Squantum, in Quincy, where it rises above tide level and thence is carried by an outfall sewer in an embankment to reservoirs on Moon Island, whence it is discharged on outgoing tides into the waters of the lower harbor. Immediately after leaving the pumping station and before reaching the shaft of the Dorchester Bay Tunnel, the sewage passes through two parallel deposit sewers where solids are collected and subsequently removed. This intercepting sewerage system of Boston was the first great undertaking of its kind in the country.

While the Boston Main Drainage System took care of the great part of the nuisance caused by the discharge into the tidal waters around Boston of sewage from that city, it did not remedy the situation caused by other communities particularly those to the north of the Charles River. Voluntary coöperation by interested municipalities being ineffectual to meet this common drainage problem, the State intervened and, by legislation passed in 1884, created the Massachusetts Drainage Commission to consider and report on general systems of drainage for the relief of valleys of the Mystic, Blackstone, and Charles Rivers and the protection of the public water supplies within these valleys; also, to consider various methods of sewage disposal in these territories.

The commission found that on the several watersheds investigated crude sewage and industrial wastes were discharged directly to streams; that water supplies were menaced in a number of instances; and that the new art of purification of sewage, although greatly needed in these populous territories, had nowhere been put into practice.

Courtesy J. Waldo Smith

KENSICO DAM OF THE CATSKILL WATER SUPPLY SYSTEM FOR NEW YORK CITY. AN EXAMPLE OF BEAUTY IN ENGINEERING STRUCTURES

The public mind was not satisfied, however, that the answer to the problem had been found in the recommendations of the Drainage Commission. The legislature directed the State Board of Health to carry the investigation further and, in particular, to consider the question of disposal of sewage in the most thickly populated portions of the Mystic and Charles River valleys. The State Board of Health attacked the problem in a most thorough manner and its report to the legislature in 1889 is a noteworthy document. The Board made exhaustive investigations and experiments regarding methods of sewage disposal by filtration, by chemical precipitation, and by discharge into tidewater.

As a result of its investigations the State Board of Health recommended a comprehensive system of sewerage works, with discharge into Boston Harbor south of Deer Island, for communities north of the Charles River and in the Mystic River valley; this system being designated as the North Metropolitan System. For the disposal of sewage from certain municipalities in the lower valley of the Charles River, namely, Waltham, Newton, Watertown, Brookline, and the Brighton district of Boston, the Board recommended another system of intercepting sewers to be connected with the Boston Main Drainage System discharging into Boston Harbor.

This exhaustive report of the State Board of Health, made in 1889, was the final step and resulted in the passage by the legislature that year of the act establishing the Metropolitan Sewerage District and creating the Metropolitan Sewerage Commission to build, maintain and operate comprehensive sewerage systems to care for the sewage of the district. Thus there came into existence, in 1889, the first Boston Metropolitan District.

IN 1652, twenty-two years after the settlement of the town, the first organized attempt was made to supply water to the citizens of Boston. In that year a private company was chartered by the General Court of Massachusetts Bay Colony under the title of the "Water Works Company." This company built a reservoir near Dock Square to hold water conveyed to it by pipes leading from neighboring wells and springs. Its purpose was to extinguish fires and to supply the inhabitants living nearby with water.

In 1795, Boston was supplied, for the first time, with water brought from a distance. In that year the "Aqueduct Corporation" was chartered and this private company brought water into the town from Jamaica Pond in Roxbury through four main pipe lines, the pipes being pitch pine logs through which holes were bored lengthwise. Two of these pipe lines were made of logs of four inch bore, and others of three inch, while the smaller pipes leading off from the main pipes had a bore of one and a half inches. This private company continued to supply water to Boston for half a century.

The first organized attempt to induce Boston to construct a system of water supply at public expense was made in 1825, three years after the town was incorporated as a city, and the subject of a municipally owned water system was agitated repeatedly for more than twenty years.

THERE was considerable opposition to the idea of having the city construct and own its water works, many citizens believing that water could best be furnished by competing private companies. Each year, however, the situation became more acute; water from Jamaica Pond

Ewing Galloway

CHINESE PUMP. THE BAMBOO WHEEL TAKES WATER FROM RIVER IN CUPS AND POURS IT INTO FLUME

was supplied to only a small portion of the inhabitants of the city, the greater part of the population being dependent upon wells which not only were becoming inadequate for the somewhat congested community, but were furnishing water of lessening purity. Finally, popular demand became so strong that legislation was secured in 1846 under which the city purchased Long Pond, now known by its Indian name of Cochituate, lying about eighteen miles west of Boston, in the towns of Natick, Framingham, and Wayland; and built a masonry aqueduct about fifteen miles long through which water from the lake was brought by gravity to a reservoir in Brookline. Lake Cochituate water was first furnished to the inhabitants of Boston in 1848 when the population of the city was about 127,000. In the early Seventies, it became apparent that Lake Cochituate was inadequate to meet the needs of the growing City of Boston, and that additional water must be obtained elsewhere. After investigation the city decided to secure water from the Sudbury River watershed lying immediately to the west of Lake Cochituate.

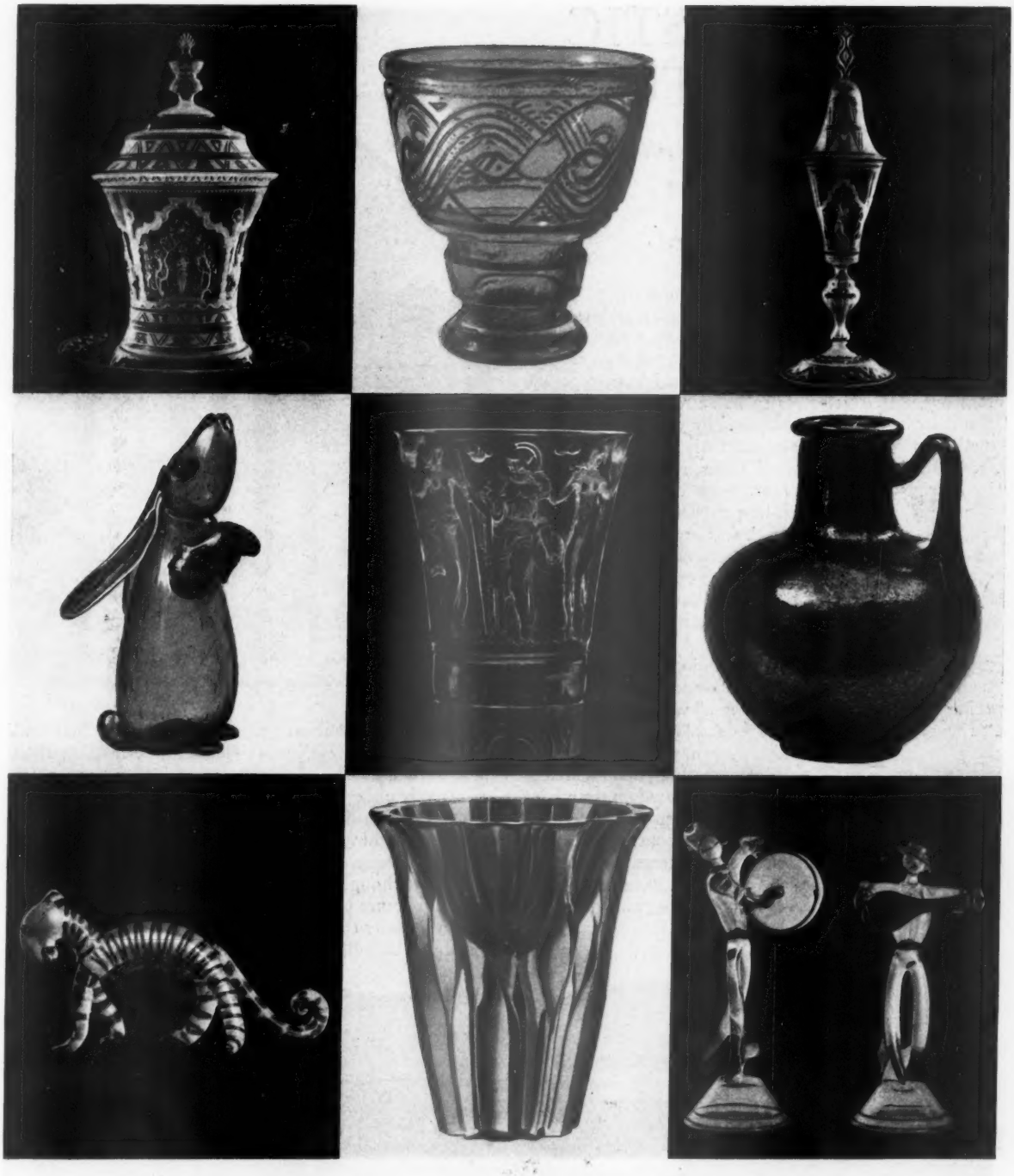
In the Sudbury River Basin, Boston built artificial reservoirs from time to time as required, and when taken over by the Metropolitan Water District in 1895 the Sudbury River System consisted of one natural pond, five completed reservoirs and a sixth reservoir under construction. Water from the Sudbury River System was first introduced into the City of Boston in 1878. It is brought to the Chestnut Hill Reservoir by the Sudbury Aqueduct, about sixteen miles in length. The Sudbury and Cochituate aqueducts are wholly independent.

In 1893 the problem of adequate water supply had again become most pressing, not alone for the City of Boston but also for most of the cities and towns in Boston's nearby territory. Again the State Board of Health was directed by the legislature to make an important investigation, this time of the broad question of a metropolitan water supply. In its comprehensive report submitted in 1895, the State Board of Health carefully analyzed possible sources of additional supply for the metropolitan territory. Lake Winnepesaukee, in the central part of New Hampshire, was rejected both because of the expense involved in bringing its water nearly 100 miles to Boston and because of the political complications involved by using a source in another state. Water could be obtained from the Merrimack River above Lowell, Mass., without encountering such serious interstate complications, but that supply would have been expensive to develop, particularly as the water of the Merrimack receives the drainage of New Hampshire's most populous communities, making filtration a necessity.

In the South Branch of the Nashua River above Clinton, however, the State Board of Health found a source of additional water supply which it considered entirely satisfactory. The stream drained a watershed which was not thickly populated and a supply of surface water of good quality could be secured. The reservoir proposed by the State Board of Health for the South Branch of the Nashua River would be capable of supplying nearly twice as much water as the Sudbury and Cochituate systems combined.

The Massachusetts Legislature of 1895 adopted the recommendations of this comprehensive report of the State Board of Health. It passed an act creating the Metropolitan Water District; providing for the acquisition by the district of the supply systems owned by the City of Boston; and establishing the Metropolitan Water Board, to administer the affairs of the district and to develop the South Branch of the Nashua River as an additional source of supply. The Metropolitan Water Board was charged with the duty of supplying water wholesale to the cities and towns of the Metropolitan Water District. The distribution of this water to the inhabitants of the several communities remained under the charge of the municipalities themselves.

PREVIOUS to 1875, the principal pleasure grounds in the City of Boston were the Common and the Public Garden, although there were also a number of smaller public grounds and squares. The Common had been set apart for the use of the inhabitants soon after the settlement of the town in 1630 and, until the beginning of the Nineteenth Century, it was used chiefly as a pasture. It has an area of forty-eight acres. (*Continued on page 210*)



Modern Glass Technology

Foreign glass workers have achieved enviable prominence in the making of decorative glass. The examples illustrated above are drawn from the second international exhibition of industrial art, this year on exhibition successively in leading American museums, sponsored by the American Federation of Arts.

In the upper row, left to right: engraved banquet table piece, Sweden; transparent crystal vase, height 9½ inches, France; engraved banquet table piece, Sweden.

Middle row, left to right: Martinuzzi rabbit, height 13 inches, Italy; beaker engraved in cameo work, height 8 inches, Austria; Martinuzzi vase, height 13 inches, Italy.

Bottom row, left to right: modeled tiger, Italy; cut crystal vase, Germany; blown glass jazz musicians, Italy.

MODERNISTIC ARCHITECTURE

Efficiency Displaces Beauty and Blights Design

By A. W. K. Billings, Jr.

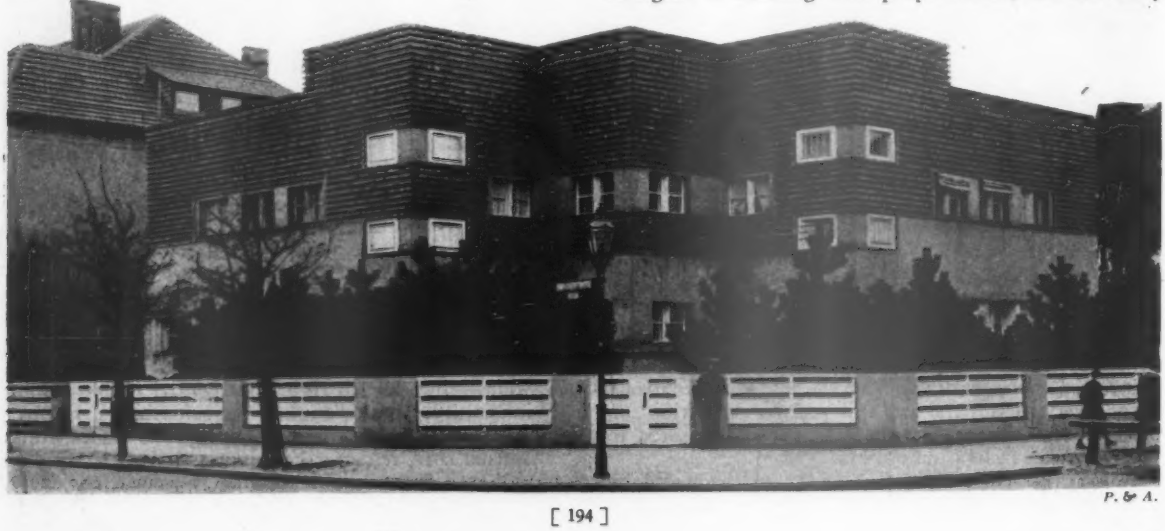
P. & A.

MODERNISTIC CATHOLIC CHURCH IN FRANKFURT, GERMANY. BELOW: PRIMITIVELY MODERN HOME IN THE REICHSKANZLER PLATZ. THE ANGULAR DESIGN IS DICTATED BY A DESIRE TO ADMIT A MAXIMUM OF AIR AND LIGHT

GOOD or bad, sound or false, lasting or fickle, beautiful or ugly — what is *modernistic* architecture? The question is not amenable to a rigorous answer, but let me begin by distinguishing between modern and modernistic. *Modernistic* architecture is contemporary architecture that attempts to be extreme and to depart from the conventional. Compared by volume of building to all that is *modern*, it is of relatively small importance. Yet it is gaining, it is talked about, it is admired, criticized, sponsored, laughed at. Some of our schools are teaching it. Others do not know whether to teach it or not. Still others eschew it. A few architects have been converted to its cause. Many will not accept it as anything more than a passing fancy, an exaggerated conception. The laity, in the main, have no ideas about it, in fact, do not understand its philosophy.

The over-ornamented buildings of the Nineteenth Century, intricately and indiscriminately embellished with architectural splendors of all periods; ginger-bread houses adorned with jigsaw extravagances; Floridian stage-set play houses — all of these, both in America and Europe have given the architect with modernistic leanings, something upon which to base his claims for a new architecture based on simplicity and utility. General public reaction to the superficial lavishness of what was fifty years ago considered beautiful has tended to give a sweet reasonableness to the modernistic logic. Post-war conditions also have contributed to the modernistic movement. Europe was poor and needed buildings. It was necessary, therefore, that these new buildings be efficient in planning, designed without waste space and free of all ornament. There are other comparatively unimportant reasons, arising from human vanity, for emphasis on modernistic architecture: a desire to create something different; the aspiration to live in and own something unusual; the obsession to be, do, or seem different (though not necessarily better).

Architecture has, in the past, been judged by the layman primarily through the pleasure it brings to the sense of sight. A building well proportioned, harmoniously

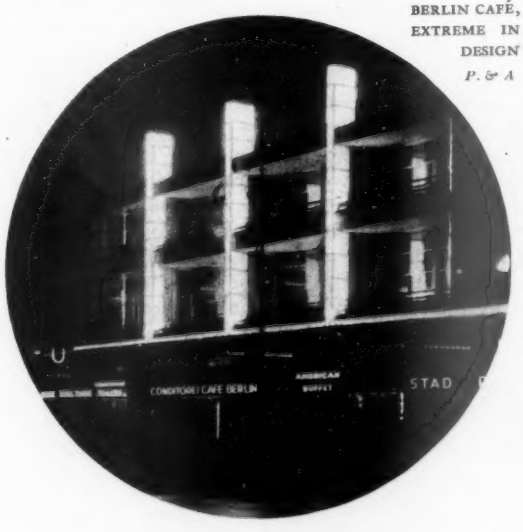


P. & A.

designed, thoughtfully situated has been called beautiful. Beauty in architecture has been accepted as a quality which gives one aesthetic delight and satisfies the moral sense.

The extremists in architecture, such as Bruno Taut * in Germany, Le Corbusier† in France, and others of the same school have cast aside the generally accepted connotation of beautiful and have adopted entirely new standards. They have said: "Efficiency is the most important element in design. The plan must be efficient — if it is efficient it is beautiful. If it is not efficient then it cannot be beautiful." Their idea of beauty is similar to that of the machinist, who, through arduous labor, careful analyses, great ability, has produced a machine, efficient, simple, clever, unlike any other.

The buildings that these architects have designed show at a glance their principles. Observe the home shown on



BERLIN CAFÉ, EXTREME IN DESIGN
P. & A

Page 194. Here is a type which is primarily efficient. Every room is situated just where it should be for the greatest convenience. Every window has the exact orientation and size conducive to maximum light and air. Here is a building as efficient as the highly perfected mechanism of the automobile, a stop watch, an airplane. But what about proportion, picturesqueness, aesthetic appeal? They are standards of slow life, now dead. They have nothing to do with modernistic design.

Such is the modernist's point of view. The buildings which result are box-like, harsh, cold, uncomfortable to the aesthetic senses. Classical pilasters, cornices, columns, moldings, and ornament are superficial and ostentatious. Pitched roofs, diamond shaped window panes, hand-hewn timbers, dormer windows, are obsolete because they are inefficient.

In short, the modernistic architect has followed his principles to an extreme conclusion. He has ignored the aesthetic desire for the picturesque, the colorful and the restful. He has sacrificed most of the prerequisites of beauty on the altar of efficiency. It is this worship of a false God that has caused the modernistic architect to forfeit his strongest claim to immortality. Only that architecture having the prerequisites of beauty has ever prospered and survived.

The fact that the deck and bridge construction of an ocean liner is a very logical and straightforward construction is no reason why a house built to resemble an ocean liner is also good, — although some architects would have us believe so. Well designed, picturesque cottages of the Seventeenth Century did not resemble stage coaches or Elizabethan galleys.

Ewing Galloway

HOME OF A STUTTGART NEWSPAPER. LIGHT AND AIRY IN PLAN; PLAIN AND UNSIGHTLY IN FORM

We cannot have, except in rare cases, the greatest efficiency combined with the most beauty, the best proportion, the most pleasing plan. Architecture must be a series of compromises. If a building is to be well proportioned and satisfying to the eye, it usually, though not always, follows that a sacrifice must be made somewhere in its efficiency. Perhaps a little added ceiling height will make a more agreeable proportion to a single room, or to a whole exterior. If such be true, then the inefficiency of adding a little waste space is overbalanced by the added attractiveness of the building. It seems just as basically wrong to sacrifice all beauty for the sake of efficiency as it is to put up buildings which are well-designed and beautiful by appearance yet totally lacking in good planning. A well-balanced architect goes to extremes in neither one direction nor the other.

The age old fundamentals of good design still exist. Modernistic architecture may contribute a modicum of new ideas, but it can never displace them.

Do not confuse the modernistic architecture which I have been discussing with other phases of modern architecture. New types of construction, new economic conditions, new social conditions have literally thrust upon us a new type of building. Call it a style if you wish,

* See MODERN ARCHITECTURE, by Bruno Taut. $12.50. x+212 pages. New York: *A. & C. Boni.*

† See THE CITY OF TOMORROW, by Le Corbusier. $7.50. 320 pages. New York: *Payson and Clarke.*

Wide World

A PARIS RESIDENCE. SIMPLE, STRAIGHTFORWARD, EFFICIENT, BEAUTIFUL — OR BOXLIKE, HARSH, CUBISTIC, UGLY?

although it will be the privilege of historians of the future to name it. It has been evolved to meet new demands, but it has been governed by the fundamentals of architecture, by proportion, logic, beauty.

Industrial buildings are in a class by themselves, and unlike the home, belong strictly to the present day. It seems very natural that their architecture should be modern, for there is nothing in the past to base it on. That such buildings have, in general, been built without superfluous ornament, and with the simple object of making them serve their purpose, has resulted in their being, in the modernist's estimation, eloquent examples of fine architecture. We agree that grain elevators, Ford factories, cement plants, blast furnaces, are good in that such buildings are logical solutions of their respective problems. But they are not beautiful by our definition of the word. Extremists go on the assumption that the warehouse, the silo and the factory are efficient, logical, and therefore beautiful. And that all buildings (including the home) should be beautiful by having the same principles applied to their design. They have, in other words, gone too far in this direction and not far enough in the matter of comfort, beauty and satisfaction of the inborn aesthetic needs of the people.

European modernistic architects are wont to skip lightly over our American architecture as being undeveloped and inconsequential. Our skyscrapers are modern if ever there existed a modern building, and it is in their design that modern architecture has thus far reached the height of its splendor. With no precedent to speak of, they have developed in a remarkably short time. They are logical for city life, efficient for business enterprises, inspiring, stalwart emblems of progressiveness. Certainly many of them are beautiful. The worst of them are beautiful by contrast to the machine-like block housing systems so prevalent in Europe, and so much admired by extremists. *(Concluded on page 216)*

By Burton Holmes from Ewing Galloway

AMSTERDAM APARTMENT BUILDING. MODERN YET IMPRESSIVE; EFFICIENT YET WELL DESIGNED

THE TREND OF AFFAIRS

Sub-Atomic Energy

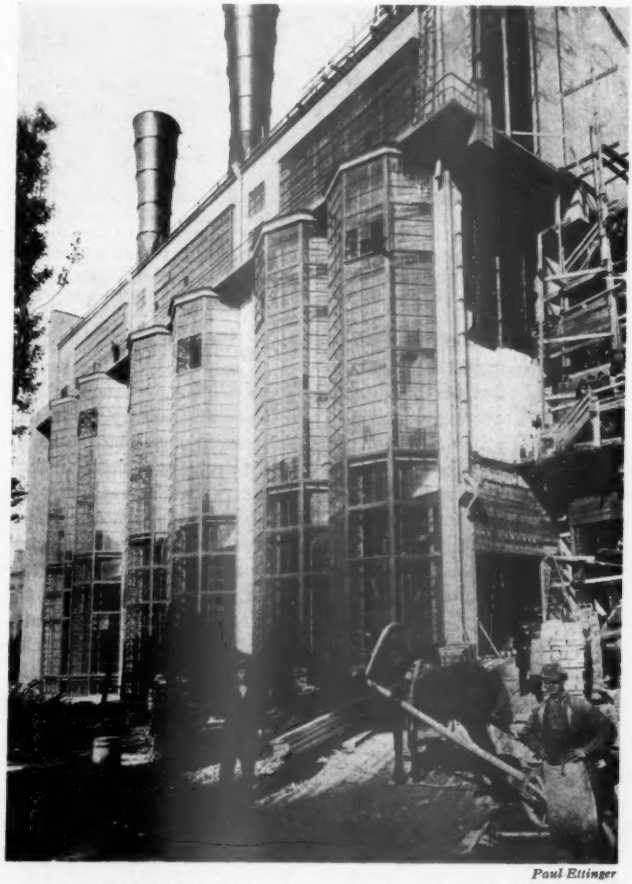
"WINGS OVER EUROPE," one of the Theatre Guild's still current plays, presents as a principal character a youthful scientist who has discovered a method of loosing enormous stores of sub-atomic energy and, thereby, a means for destroying the world or giving its possessor unlimited powers. To be sure the science of the stage is usually bad science; the dramatists in creating illusion, even if they knew science, would probably employ it in a fictitious manner.

The release of sub-atomic energy, however, as presented in "Wings over Europe," is a straw baby that disturbs the minds of a good many people. It was fortunate indeed that Dr. Robert A. Millikan, in his presidential address at Des Moines before the Association for the Advancement of Science, took occasion to deny the charge that science is giving children matches with which to play by its preparations to tap enormous stores of sub-atomic energy.

Dr. Millikan had in mind the charge made by Professor Soddy of Oxford and the subsequently expressed apprehensions by the Bishop of Ripon. "She [science]," says Dr. Millikan, "has kept steady since Mr. Soddy raised the hobgoblin of dangerous quantities of available sub-atomic energies and has brought to light good evidence that this particular hobgoblin, like most of the bugaboos which crowd in on the mind of ignorance, was a myth.

"It is exceedingly fortunate that Mr. Soddy's fears did not at the time he uttered them induce a terrified humanity, like a child frightened by its fear in the dark, to stop its efforts to get more light. . . .

"Now the new evidence born of new scientific studies is to the effect that it is highly improbable that there is any appreciable amount of available sub-atomic energy for man to tap anyway; in other words, that henceforth men like the Bishop of Ripon, who are living in fear lest some bad boy among the scientists may some day touch off the fuse and blow this comfortable earth of ours to star dust, may go home and henceforth sleep in peace with the consciousness that the Creator has put some fool-proof elements into his handiwork, and that man is powerless to do it any titanic physical damage anyway."



Paul Ettinger

THE STRIKING BOILER HOUSE OF THE MOSCOW MUNICIPAL ELECTRIC WORKS

The Safest Plane

AN AIRPLANE which climbed steeply into the skies and landed with a run of only thirty feet to win $100,000; wounded feelings and several lawsuits. So came to a close the Safe Aircraft Competition of the Daniel Guggenheim Fund for the Promotion of Aeronautics, which, having spent more than $5,000,000 in the space of a few years, now slips a new page into the loose-leaf binder of the history of aviation in America, and, objectives attained, ends its existence.

Having passed the eighteen requirements for the theoretically safe airplane, the three-place cabin biplane, *Tanager*, designed by the Curtiss-Wright Corporation, won the preliminary award of $10,000, and after the final tests, Captain E. S. Land, S.M. '07, Vice-President of the Guggenheim Fund, made the award.

Aeronautical engineers and members of the board of judges, among them Edward P. Warner, '17, one-time Head of the Course in Aeronautical Engineering at Technology and Assistant Secretary of the Navy for Aeronautics, and now an editor, watched Lt. Stanley M. Umstead, Army pilot, drive the *Tanager* up in an almost vertical climb to hurdle a tower and land in thirty feet. The pilot called it the safest plane he ever flew.

Said Captain Land in presenting the final award: "Moving masses cannot be made fool-proof but they can be made safe. Kinetic energy can always do damage to a

Ewing Galloway

AIR VIEW OF PRESTON, LANCASHIRE, ENGLAND, WITH ITS MILLS AND VAST NUMBER OF TENEMENTS SURROUNDING THEM. THE CONGESTION OF THE HOUSES OF THESE MILL WORKERS IS OBVIOUS. COMPARE WITH THE MODEL VILLAGE SHOWN ON OPPOSITE PAGE AND READ "PURBLIND CITIES" ON PAGE 200 FOR COMMENTS ON SIMILAR AMERICAN COMMUNITIES

fool. The Fund's idea was to see a plane developed that the lay pilot could fly with satisfaction, security, efficiency, and safety. The fundamental idea of the Fund throughout this competition was: 'What we want in aviation is progress.'

"Tangible results are before you today. There is nothing revolutionary about the winner but there are a number of evolutionary ideas transplanted from the design board to the air in a flying competition in a most efficient manner. American aviation may well be proud."

Theodore P. Wright, '18, chief engineer of the Curtiss-Wright Corporation, and Robert R. Osborne, project engineer, were given credit for the design of the *Tanager*. "We started two years ago," said Osborne, "and spent the first six months drawing pictures." Five planes were designed before the *Tanager* was chosen.

The nearest competitor was a Handley-Page airplane which did not fulfill all the rigid requirements of the competition. Frederick Handley Page has brought suit against the winner for infringement of patents in building the *Tanager* with slotted wings. And Professor Alfred Leight, Chilean inventor and engineer, whose bird plane failed to meet requirements, charges patent infringement against Handley Page.

Originally more than a hundred planes were scheduled for competition. The number dwindled to twenty-seven formal entries, and of these only fifteen were finally presented at Mitchell Field for demonstration.

From the Daniel Guggenheim Fund for the Promotion of Aeronautics came the funds which built the Daniel Guggenheim Aeronautical Laboratory at Technology. Many other engineering colleges benefited from the same source. Now, in the words of Daniel Guggenheim, the founder, "Our objectives have been attained. The plane sought is built and flying."

Citadels of Din

HEADWAY is reported by New York's Noise Abatement Commission in its study of metropolitan hubbub and means of decreasing it. Sensitive instruments are being actively moved hither and thither making records of the tumult at various points on Manhattan Island for subsequent laboratory investigation; increasing consideration is being given to the baneful effects of noises on humans and to enlarging the output of workers by providing for them quieter environment. No less than sixteen New York civic organizations, representing billions of dollars of property, are now combined to make war on the racket.

Dr. E. E. Free, whose five years of personal investigations led to the appointment of New York's present Commission, has estimated that on the streets of modern cities people are from one-third to one-half deafened by the din and roar of the mechanical contrivances that surround them. No less an optimist than Thomas Alva Edison goes further and has been quoted as predicting that increasingly noisy cities will end by deafening all their citizens permanently.

Though New York's effort, as befits its magnitude, is the most concerted and comprehensive yet undertaken, it is not unique. In England the matter has been brought to the attention of the Minister of Health by a joint deputation from the British Medical Association and the People's League of Health and recent information from Germany also shows that investigations are going on there. One German report states that a group of skilled workers, assembling a mechanical device in a room adjacent to a boiler shop, had seventy-five per cent of their products rejected as imperfect, but, upon transfer to quieter surroundings, rejections dropped to five per cent

Ewing Galloway

VILLAGE, NEAR ROSSINGTON, DONCASTER, BUILT TO HOUSE WORKING MEN AND THEIR FAMILIES. IN THE LAST FIVE YEARS MANY PROJECTS OF THIS SORT HAVE BEEN CARRIED OUT IN ENGLAND. ALL HOUSES ARE SERVED BY ONE HEATING PLANT. MODERN CONVENIENCES, SANITATION AND OTHER ADVANTAGES FURNISHED AT MODERATE RATES. CONTRAST WITH DISTRESSFUL CONDITIONS ON OPPOSITE PAGE

and output increased more than thirty per cent. In another German instance, stopping a noisy fan raised production fifteen per cent in spite of poorer ventilation.

Interrupted sleep and frayed nerves are the common lot of city dwellers, all of whom, says Robert Armstrong-James, himself an English authority, are neurotics to whom sleep is indispensable. "Generalized auditory degeneration," is the expression applied by C. P. Wilson, writing in the *Nineteenth Century and After* of London, to the well-known occupational disease experienced by boiler workers, taxi drivers, and mechanics exposed to a constant bombardment of noises.

But sudden and violent noises, although stimulating to the naturally sluggish and unambitious, are admittedly equally disturbing to normal persons and injurious to their health. Experiments, undertaken during the course of the present New York study at the Bellevue Hospital, have already yielded certain supporting data. The method has been to observe the reactions on blood pressure, heart action and brain pressure of varying noises from mild ones up to the sudden bursting of a paper bag behind the patient's back. The conclusions set forth in a preliminary report list five harmful effects:

"1. Hearing is apt to be impaired in those exposed to loud noises.

"2. Noise interferes seriously with the efficiency of the worker. . . .

"3. In the attempt to overcome the effect of noise, great strain is put upon the nervous system, leading to neurasthenic and psychasthenic states. Because of the incessant noise of the city, quiet needed for recuperation has to be sought in the country.

"4. Noises interfere seriously with sleep, even if a few become tolerant. All noises on streets and within doors should be minimized during the sleeping hours (11 P.M. and 7 A.M.). Day noises interfere with innumerable convalescents in hospitals and in private homes throughout the city, and with persons like night nurses, typesetters, and others who are compelled to sleep by day.

"5. It is well established that the normal development of infants and young children is seriously interfered with by constant loud noises."

Indoors already a good deal of hushing has been accomplished, for business has come to a realization, in a general way, of the impaired efficiency that results from noise. Within six months, some forty New York financial houses have been sound-treated and the New York Life Insurance Company Building, designed by Cass Gilbert, '80, may be considered a forerunner of the "noiseless skyscraper." It is extraordinary in its quietude for more than 400,000 square feet of it have been insulated.

First in importance is the attention which was given the 2,180 windows, their frames of bronze and glass being heavier than usual and so designed that the windows rest in a cushion. Every detail about them is kept fast on the theory that one rattling screw in a frame soon means a rattling window, a kind of broadcasting station for every noise rising from the street. This principle of heavy glass and heavy frame held in a bronze cushion was extended to partitions used throughout the many floors of the insurance company's offices and the reduction of noise from outside, and its better control inside, have materially reduced the number of partitions required. A majority of the 2,180 windows are closed a large part of the time, and can be closed all the time, without discomfort, for they are only a supplementary means of ventilation. Every one could be sealed and the thousands of workers suffer no bad effect. This construction presages the new buildings that are to come. New insulating materials are being evolved and new quieting devices discovered.

Ewing Galloway

OBSERVING THE STARS THROUGH THE 100-INCH TELESCOPE AT THE MT. WILSON OBSERVATORY IN PASADENA, CALIF.

TRAFFIC and street noises obviously create a good deal of any modern city's uproar, as three inches of snow have demonstrated by reducing the volume of New York's sound a fourth. Dr. Donald A. Laird, Director of the Psychological Laboratory at Colgate University, claims that the noise intensity at the corner of Tremont and Stuart Streets in Boston "is barely forty sensation units where there is no traffic. But with traffic present, this intensity quickly rises to sixty-five units." Dr. Free asserts that in the congested portions of a typical American city "about three-fifths of the noise is produced by automobile trucks, about one-fifth by street cars, and the remaining fifth by excavation and building machinery, motor horns, and other miscellaneous sources."

Stricter enforcement of motor discipline can be expected automatically to diminish the screech of brakes and the squawk of motor horns. Traffic lights will also aid in the retirement of traffic officers' whistles, but further legislation will be imperative to cope with many of the other nuisances.

Dr. Free says he is convinced "that one simple regulation denying the city streets to any vehicle, horse-drawn or automotive, having any loose or rattling part would decrease city noise, except perhaps on street-car streets, by at least fifty per cent. Combined with a few equally reasonable regulations about public radio loud-speakers, useless tooting of automobile horns, mufflers on excavating machinery, and the like, this would reduce the noise of most cities to quite tolerable levels with scarcely any cost or business interference. The servicing of trucks, automotive experts report, probably would more than pay for itself in lower upkeep and longer life."

If the Noise Abatement Commission concurs in Dr. Free's belief, any steps taken to put his proposals into effect should meet with overwhelming popular favor. Of course, cognizance must be taken of special conditions in New York where many persons are up at all hours and insist upon making a joyful noise, or listening to what somebody else thinks is joyful. The Sanitary Code of New York has for some years specified that roosters are forbidden to crow at night, that "getting a dog to bark all night" may mean a fine, that cattle, pigs, sheep, and chickens passing through the city in trains to their finales must be kept still. These infringements the Noise Commission will, presumably, consider closed issues. But, as yet, no workable suggestions have been proposed to muffle crying babies, or dogs that bark of their own accord, or talking neighbors, all of which in time must yield to the inexorable march of the abaters.

Purblind Cities

ALREADY The Review has many times asseverated that the adoption by American cities of comprehensive and intelligent regional plans, as well as methods for noise and smoke abatement, is imperative if we are to have metropolitan areas free from the chaotic and choking congestion, the nerve-wracking roar, and the filth that is beginning to prevail. The immediate need is that the ordinary citizens as well as the office-holders recognize the acuteness of the problem, for its solution depends upon the coöperation of every component of a metropolitan community. Professional city planners, architects, physicians, and social critics have long perceived the need and shouted about it. In books, speeches, and the press their pleas are growing into a crescendo that can hardly fail to move municipal constituencies to action.

The Chairman of the Committee on City and Regional Planning of the American Institute of Architects, Charles H. Cheney, has prepared a report on the work carried on in this field during 1929. Three-fourths of the buildings erected in 1929 were "so ugly, so badly planned, so inappropriately located or on such narrow or inconvenient streets as to have been a liability instead of an asset, almost from the day they were completed," says he. As a natural result of man's inclination to destroy what is ugly in buildings, this indiscriminate construction "is the greatest economic waste of our time."

Mr. Cheney counted 750 planning commissions operating in the United States and 840 cities which have some kind of zoning regulations. Most of these commissions or cities, however, are badly handicapped by lack of funds and the quality of their work is yet inadequate. Of the

Beauty in the Machine Age

SHADES AND SHADOWS

A morning snapshot of sun rays streaming through an east window of the Grand Central Terminal Concourse, New York. On the balcony can be seen two coaches of the DeWitt Clinton train of 1831

really great plans formulated in 1929, the New York Regional Plan is the most notable, ranking with the proposed development of the National Capitol recently authorized by Congress at the urging of President Hoover and Secretary Mellon. The St. Louis water-front development, the Chicago development of its lake-front system, and Philadelphia's great regional plan also represent hopeful progress.

Rendering by Hugh Ferriss

BANK OF THE MANHATTAN COMPANY BUILDING AT 40 WALL STREET; SIXTY-SEVEN STORIES, 920 FEET HIGH. ARCHITECT: H. CRAIG SEVERANCE

Mr. Cheney studied apartment house architecture and he finds that apartment houses which occupy only fifty or fifty-five per cent of the land on which they were situated, have a much greater value than those using up to seventy per cent. The U-shaped apartments are the most profitable and sought after by permanent tenants. "The social well-being and the future stamina of our citizens require that we give all families plenty of room, sunlight and air to breathe, and that we do not allow them to congest too many under the same roof, rubbing elbows on the stairs, bringing about the looseness in living and morals which is so evident in the apartment-house cities of Europe."

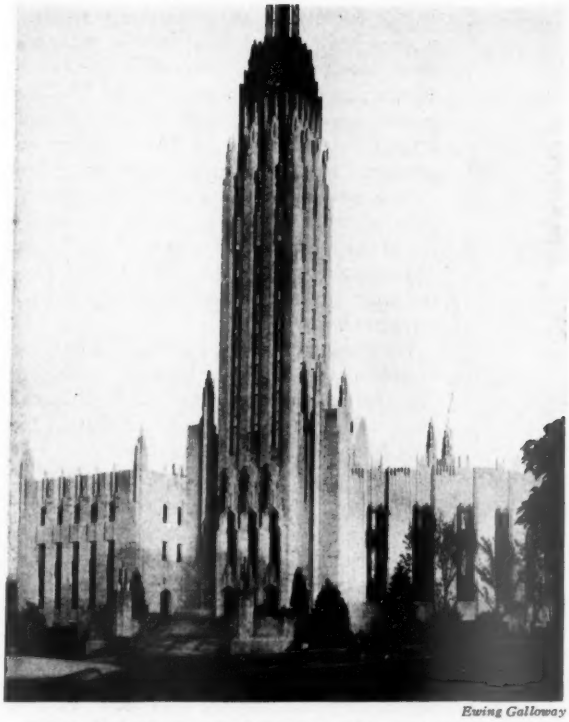
Engineers Laid Off at Forty

LAST AUGUST Stuart Chase, '10, writing in *Harper's*, called nation-wide attention to the growing unemployment caused by mills and shops discharging men upon their reaching an arbitrary age limit, often put as low as forty. Not only are men laid off early, but after attaining an age of forty or a little more they find it nearly impossible to obtain new jobs. The National Association of Manufacturers, as the result of a recent survey, found that thirty per cent of its members have maximum hiring limits. The most frequent limit for the skilled worker is fifty, and for the unskilled forty-five.

That it is a problem facing professional men, particularly engineers, as well as workmen, is indicated by its discussion at a meeting of the American Engineering Council last month. The plight of the professional engineer at the forty-year dead line "is a very real problem," declared Arthur W. Berresford, managing director of the National Electrical Manufacturer's Association and retiring President of the Council. "It seems unbelievable that a trained man of forty, an age when, as an engineer, experience has brought him to his real producing value, that such a man should find difficulty in making a new connection because of his age," Mr. Berresford said.

"Yet some of the larger industrial establishments are almost barred to him by reason of the restrictions of group insurance or pension provisions. The bringing of these conditions into the light by the American Engineering Council will be no small service to society."

Mr. Chase pointed out how this situation is partly brought about by the group insurance and pension plans mentioned by Mr. Berresford. The older the average age of the factory or office force, the higher the premiums under the group insurance schedules. Furthermore, if a jobless man seeks employment in an office which has a pension plan, there is a strong economic motive to discriminate



Ewing Galloway

BOSTON AVENUE METHODIST CHURCH, TULSA, OKLAHOMA. RUSH, ENDACOTT AND RUSH WERE THE ARCHITECTS (GOFF AND ROBINSON, ASSOCIATES) OF THIS REVOLUTIONARY DESIGN

against him if he is past his prime. Being older he will be nearer the pension provision, hence the more costly to the company.

An excess of human philanthropy is thus working out in terms of human tragedy. The Review commends the Engineering Council for recognizing the problem and awaits with hope the results of its study of the economic status of the nation's engineers.

Science at the World's Fair

THE FIRST Chicago World's Fair held in 1893 profoundly affected American architecture and American science by its emphasis on progress in these two fields. *The Dynamo and the Virgin*, the famous chapter in "The Education of Henry Adams," expresses the great awakening that the technological exhibitions at the World's Fair brought to many people.

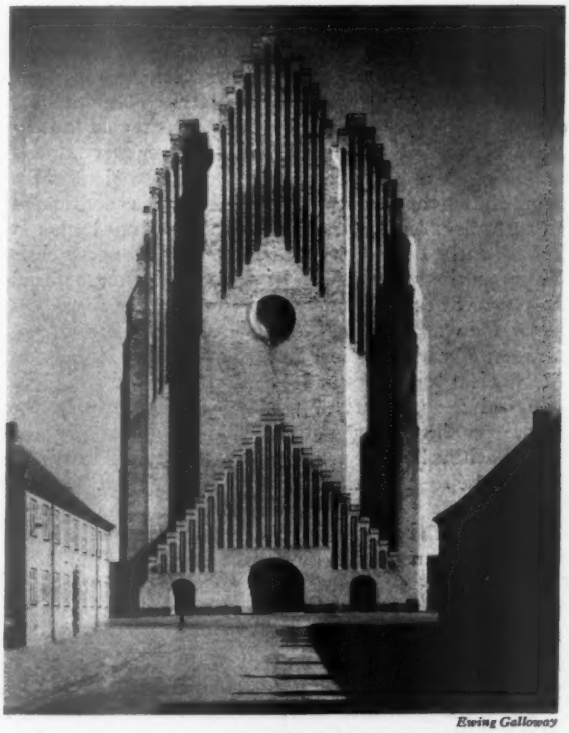
It is appropriate, therefore, that the organizers of the next World's Fair, to be held in Chicago in 1933, have decided that it should represent a century of science and that its direction should be entrusted to the country's most able scientists. The general plan adopted provides for an exposition showing the major contributions of pure and applied science in industrial development during the last 100 years. This exposition, in "dramatic philosophy and pattern," is to be divided chronologically by stages of development, by stages of manufacture, by stages of growth, or by stages of production.

A science advisory committee of the National Research Council has undertaken the task of organizing the scientific exhibitions and Dr. Frank B. Jewett, '03, President of the Bell Telephone Laboratories, Inc., has accepted the chairmanship of that committee. Assisting him, as Director, is Maurice Holland, '16, and as Secretary, Robert P. Shaw, '23.

Moon Strength

ASTRONOMERS have long been aware that the moon exerted a gravitational pull on the earth's crust, but they believed it resulted in too slight a movement to be measured. It is Dr. Harlan T. Stetson, Director of the Perkins Observatory of Ohio Wesleyan University, who has produced evidence to show that the change of position may amount to five or six feet, perhaps even more. These figures he advanced at the recent annual meeting of the American Astronomical Society held at Harvard. Dr. Stetson has been studying latitude variation in relation to the moon's position and he showed in his paper that a change in the position of the moon may produce a change in the direction of gravity, causing a shift in the earth's crust, and thus the variation of latitude.

In another paper delivered at the same time, Professor Knut Lundmark, Director of the Lund Observatory of Norway, said that the most far-reaching measurements into space have included mathematical projections to the distance of 150,000,000 light years. This is an appalling distance, considering that light travels at the speed of 186,000 miles per second. He also made the statement that the nebulae at a distance of 150,000,000 light years from the earth are by no means the farthest objects away.



Ewing Galloway

A CHURCH FAÇADE IN COPENHAGEN WHICH SIMULATES A HUGE PIPE ORGAN. ARCHITECT: P. V. JENSEN

W. SPENCER HUTCHINSON, '92, HEAD OF THE INSTITUTE'S DEPARTMENT OF MINING AND METALLURGY SNAPPED THIS 40,000-TON BLAST PREPARED BY THE CHILE COPPER MINE AT CHUQUICAMATA

Wilfred Lewis: 1854–1929

THE SUDDEN DEATH at sea of Wilfred Lewis, '75, while on a trip around the world, following his attendance at the World Engineering Congress, comes as a shock. On December 29, he was stricken with apoplexy on the S. S. *President Wilson*, not far from Egypt, and he was buried at sea.

After his graduation from the Department of Mechanical Engineering at the Institute, he went to work for William Sellars and Company of Philadelphia, beginning as mechanic and rapidly filling the intervening steps until he became one of its directors. In 1900 he became President of the Tabor Manufacturing Company, allowing much of his time to go to invention. Over fifty patents are the result of his researches, the most notable of them being a study of gear teeth, on which he was considered an authority. As early as 1892 he had developed what is known as the Lewis formula, which is the primary basis for computing the strength of gear teeth. This material he presented to the Franklin Institute in the form of a paper. He was made chairman of a special research committee on gears, appointed by the American Society of Mechanical Engineers in 1922, for the use of which he designed a special testing machine to determine the actual running or dynamic load on the teeth of gears. This machine he later presented as a loan to the Institute. In 1927 he received the A.S.M.E. Gold Medal "for his contributions to the design and construction of gear teeth," and the Longstreth Medal of the Franklin Institute for perfecting a shaking machine for molds.

Mr. Lewis took great interest in the work of the Institute's Department of Mechanical Engineering and his friendship with the late Professor Gaetano Lanza, who guided the Department from 1871 to 1911, was based on a desire to serve by giving of his time and money.

The third great interest of his life was the promotion of the Taylor system of shop management, expounded by his friend, the late Frederick Taylor. As President of the Taylor Society, he was constantly seeking to promote research in industrial management, along the lines adopted by the Tabor Manufacturing Company. One of his last public appearances was at the World Engineering Congress in Tokio, when he presented to the Japanese Engineering Society a valuable transcription of the recommendations of Mr. Taylor for the reorganizing of the management system of the Tabor Manufacturing Company. His active, joyous share in the events of the Congress will not soon be forgotten.

For these facts about his life, The Review is indebted to Professor Edward F. Miller, '86, Head of the Department of Mechanical Engineering, and to John R. Freeman, '76, Life Member of the Corporation.

Counting Noses

SOME three thousand years ago King David sent his minions forth to take what is believed to be the first authentic census, a task which sought to number the people of Israel and Judah. For nine months and twenty days those early census takers knocked at doors and tugged at tent flaps, and finally reported they had counted 1,300,000 "valiant men" of the sword. All of which indicates that what King David really wanted to know was how many fighting men he could count on for his next war.

Next April 100,000 men and women will go into action at the call for the Fifteenth National Census of the United States. The first census, taken in 1790, required thirteen months and the population reported was less than 4,000,000 souls. Workers in the forthcoming census must complete their national stock taking within thirty days. In that short space of time they must secure comprehensive information about the existence and pursuits of some 120,000,000 citizens, including their sex, age, nativity, occupation, and the value of their homes.

That, however, is but the hearthstone aspect of the undertaking, for in the various branches of the Census it will be necessary to ask some 20,000 questions calculated to throw light on almost every subject from the price of prunes to the distribution of perambulators. Meantime some 40,000,000 printed copies of schedules are being prepared for the army of enumerators.

With the growing complexity of our national economic life it has become necessary to measure it in one dimension after another, and in the forthcoming census the survey will, for the first time, take into consideration the problem of distribution as a corollary to the familiar question of production. To the enumeration of population, farms, and factories, there will be added an enumeration of the outlets through which the products of industry move into the fields of consumption. This information will include data from every store and wholesale dealer regarding sales, inventory, number of employees, salaries, rent, and other expenses.

To accomplish their part of the great task, census enumerators must gather information from every city and hamlet, 6,000,000 farms, 14,000 mines and quarries,

100,000 irrigation and drainage projects, nearly 200,000 factories, 2,000,000 stores, and some 30,000,000 households.

The population of the continental United States is now increasing at the rate of about 1,300,000 persons per year, or approximately one person every twenty-three seconds. The total increase is made up of the annual excess of births over deaths, which amounts to 1,150,000, and the excess of immigration over emigration, which amounts to an additional 240,000 per year. This year the population will be more than thirty times as great as it was in 1790, and nearly twice what it was in 1890, only forty years ago.

The Census of 1930 recalls the part that General Francis Amasa Walker, third President of Technology, played in the Censuses of 1870 and 1880, which he directed. Although General Walker was but twenty-nine years old when he was appointed Superintendent of Census in 1869, he carried out the task with a skill and wisdom worthy of a man much older in experience. Hampered by a defective law and handicapped by the doubtful value of the information gathered by a horde of workers who seized upon the census as a means of collecting debts of political patronage, General Walker carried his work to a conclusion. Much of the information gathered he frankly and courageously repudiated as false and misleading. Aside from the errors to which General Walker directed attention, the work was the finest of its kind. The form in which the statistics were presented, and the excellent printing and cartography brought world-wide admiration. With the approach of the decennial census of 1880, which was afterwards referred to as the "Jumbo of Censuses," General Walker was recalled to Washington to undertake the task again. In 1881 he accepted the Presidency of the Institute.

The Pulp Rush

IN THE DYING DAYS of Andrew Johnson's administration, his Secretary of State, William H. Seward, concluded the purchase of Alaska from the Czar of Russia. Formal transfer was at Sitka, October 18, 1867, the consideration being $7,200,000. Neither Johnson nor Seward lived to see their faith in the "land of the polar bear and gold pan" vindicated. Yet it turned out to be a productive treasury, yielding, so far, over ninety-five times its purchase price in fish, fourteen times in furs, and eighty-one times in minerals, of which fifty times have been in gold alone. But even now, pulp-wood, the fourth great natural resource of "Seward's Ice-Box," remains almost untapped. Conservative estimates of the United States Forest Service place the total volume of virgin timber in southeastern Alaska as sufficient for the production of 1,000,000 tons of newsprint annually, without depleting the wood supply.

To make this resource available the Forest Service has awarded two leaseholds, and construction on paper-making plants at Juneau and Ketchikan, each with a daily capacity of 500 tons, is due to start this spring. Completion will take about two years. A combination said to represent the San Francisco *Chronicle* and the Los Angeles *Times* is to locate near the former metropolis, which is the capital of the Territory, and the Crown-Zellerbach group, the largest newsprint manufacturers on the Pacific Coast, near Ketchikan. Both towns are on tidewater in the "panhandle" of southeastern Alaska, Juneau being some 1,000 miles steaming northeastward from Seattle, while Ketchikan, the chief port of entry for the Territory, is about 600. Each site has abundant water power and a fair wood supply, the principal difficulty being to operate at such remote locations. Climatic conditions, however, will be much less severe than in Quebec and Ontario, the main present North American sources of newsprint. July, the warmest month in Juneau, averages about 60, and January, the coldest, averages but five degrees below freezing. During a period of thirty-three years at Juneau, only fifty-six days of zero or below were recorded.

Most of the standing timber in southeastern Alaska is in the Tongass National Forest and favorable rainfall conditions (at Ketchikan the normal annual precipitation is 162.3 inches) have minimized fire losses which, it is said, destroy in Canada an amount of wood equal to that actually cut.

Although but five per cent of the timber cut in North America and Europe goes into wood pulp, by comparison with ninety-five per cent used for timber construction of all sorts, fuel, and so on, the annual newsprint consumption of the United States (based on 1928 figures) is estimated to be 3,600,000 tons. Of this, 100,000 tons is imported from Germany, Finland, Sweden, and Norway, and 1,700,000 tons (ninety-one per cent of Canada's output) from Canada. Existing mills worked at about ninety per cent capacity during 1929 and maximum development in the eastern sections of both Canada and the United States has been reached.

Wide World

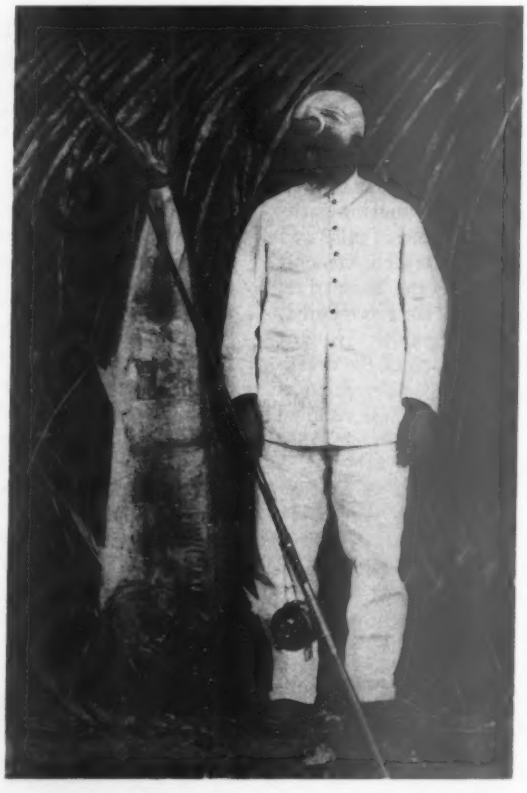
CURTISS "TANAGER" PLANE, WINNER OF THE $100,000 DANIEL GUGGENHEIM PRIZE FOR THE SAFEST AIRPLANE. SEE PAGE 197

Departure

ANNOUNCEMENT made public early in January reveals that a long and fruitful career of service to the Institute will come to a close at the end of the present academic year with the retirement of Professor Harry W. Tyler, '84. Fifty years have lapsed since Dr. Tyler registered as a Freshman in the Course in Chemistry, at the age of seventeen.

After graduation, he was an Assistant on the Institute Staff for two years, studied a year at Göttingen, took his Doctorate in Philosophy at Erlangen in 1889, meanwhile having held the grade of Instructor on the Institute Staff *in absentia*. In 1890, at the age of twenty-seven, he was made an Assistant Professor, at twenty-nine an Associate Professor, at thirty a Professor, at thirty-eight Head of the Department of Mathematics, at forty-seven Walker Professor of Mathematics.

For a period of nearly fifteen years prior to 1906, Dr. Tyler served as Secretary of the Faculty, in those days an inclusive post which, until 1902, combined the duties of Dean, Registrar — and often Medical Director — as well as those of the Secretaryship. Dr. Tyler's interest in the administrative phases of education has persisted since 1906 as is evidenced by his two years' Chairmanship of the Faculty (1913–1915) and by his Chairmanship of important Faculty Committees, notably those on Courses of Instruction and Admissions. Since its foundation in 1901, he has been active in the work of the College Entrance Examination Board, of which he is now Vice-Chairman.



EX-PROFESSORIAL AVOCATION: DANA P. BARTLETT, '86 PROFESSOR OF MATHEMATICS, NOW RETIRED, EXHIBITS A DOLPHIN CAUGHT IN TAHITI LAST DECEMBER

Aside from his academic duties, Dr. Tyler has interested himself in the social life of the Institute and has been President of the Faculty Club practically since its foundation in 1919. Following his retirement from the Institute, Dr. Tyler expects to devote his time to furthering the interests of the American Association of University Professors, of which he is General Secretary, and as a Consultant to the Library of Congress on scientific literature. In so doing he will carry out his wish to follow the line of "maximum usefulness rather than of least resistance" for Dr. Tyler's is not a retirement due to "impaired health."

Reunion Bulletin

PLANS for the All-Technology Reunion to be held June 6 and 7 are rapidly being extended. The tentative program includes the following:

1. Registration and open house at the Institute Friday morning and afternoon, June 6.
2. General luncheon in Walker Memorial and separate fraternity luncheons in fraternity houses Friday noon, June 6.
3. President's and Corporation's reception and tea at the President's house Friday afternoon, at 4:30 P.M.
4. Separate Class Dinners Friday evening at 6:30 P.M.
5. All day outing and luncheon Saturday, June 7.
6. Closing banquet Saturday evening, June 7, including scientific demonstrations and a nationally known speaker. Dancing afterwards.

Under the leadership of Thomas C. Desmond, '09, General Chairman, and Samuel C. Prescott, '94, Vice-Chairman, other committees are being formed to supervise the different events. The Treasurer, George L. Gilmore, '90, has already secured a Guaranty Fund of nearly $5000 and he expects that this will grow to an even larger amount.

Mr. Desmond announces the appointment of the following men as national Vice-Chairmen of the Reunion: James I. Banash, '06, Chicago; Richard H. Ranger, '11, New York; Elisha Lee, '92, Philadelphia; Baron Takuma Dan, '78, Japan; Alexander S. Garfield, '86, France; Howard M. Edmunds, '05, England; Francis J. Chesterman, '05, Pittsburgh; Burt R. Rickards, '99, Albany; W. Rawson Collier, '00, Atlanta; Joseph T. Lawton, Jr., '06, Baltimore; Dr. Oscar G. Thurlow, '04, Birmingham; Eugene L. Klocke, '21, Buffalo; George E. Merryweather, '96, Cleveland; Frank F. Bell, '10, Dallas; Frank E. Shepard, '87, Denver; William R. Kales, '92, Detroit; Hermann C. Henrici, '06, Kansas City; Don Hull McCreery, '22, Los Angeles; Armand D.

Koch, '92, Milwaukee; William H. Bovey, '94, Minneapolis; John L. Porter, '00, New Orleans; J. Lawrence Mauran, '89, St. Louis; Jonathan E. Woodbridge, '93, San Francisco; Dr. Willis R. Whitney, '90, Schenectady; Neal E. Tourtellotte, '17, Seattle; Proctor L. Dougherty, '97, Washington; Albert F. Sulzer, '01, Rochester; J. Lloyd Wayne, '96, Indianapolis; Everett R. Cowen, '07, Louisville; Edgar M. Berliner, '06, Montreal; Denton Massey, '24, Toronto; Howard S. Morse, '03, Akron; Charles G. Merrell, '88, Cincinnati; Erle F. Whitney, '07, Portland.

Annual Dinner

UNFORTUNATELY the Annual Dinner of the Alumni Association falls this year just after this issue goes to press, making it impossible to render at this time anything more than an advance notice based on the already published program and on years of experience in reporting these stately affairs.

If the forecast of the Committee on Assemblies is followed to the letter, then the following events took place on January 18 — the change of tense merely indicating that this story will be written in terms of the time that it will be read by the reader. The President of the Alumni Association, Paul W. Litchfield, '96, also President of the Goodyear Tire and Rubber Company and the Goodyear-Zeppelin Corporation, presided at the dinner in Walker Memorial and introduced first Dr. Stratton, who made his usual report on the state of the Institute, reviewing the work that has been done and the progress that has been made since the last Annual Dinner. Samuel C. Prescott, '94, followed, speaking in his capacity as Vice-Chairman of the All-Technology Reunion to be held in June. He outlined the plans that were being formulated (see opposite page) and emphasized the dignity and importance which is to characterize this Five-Year Celebration.

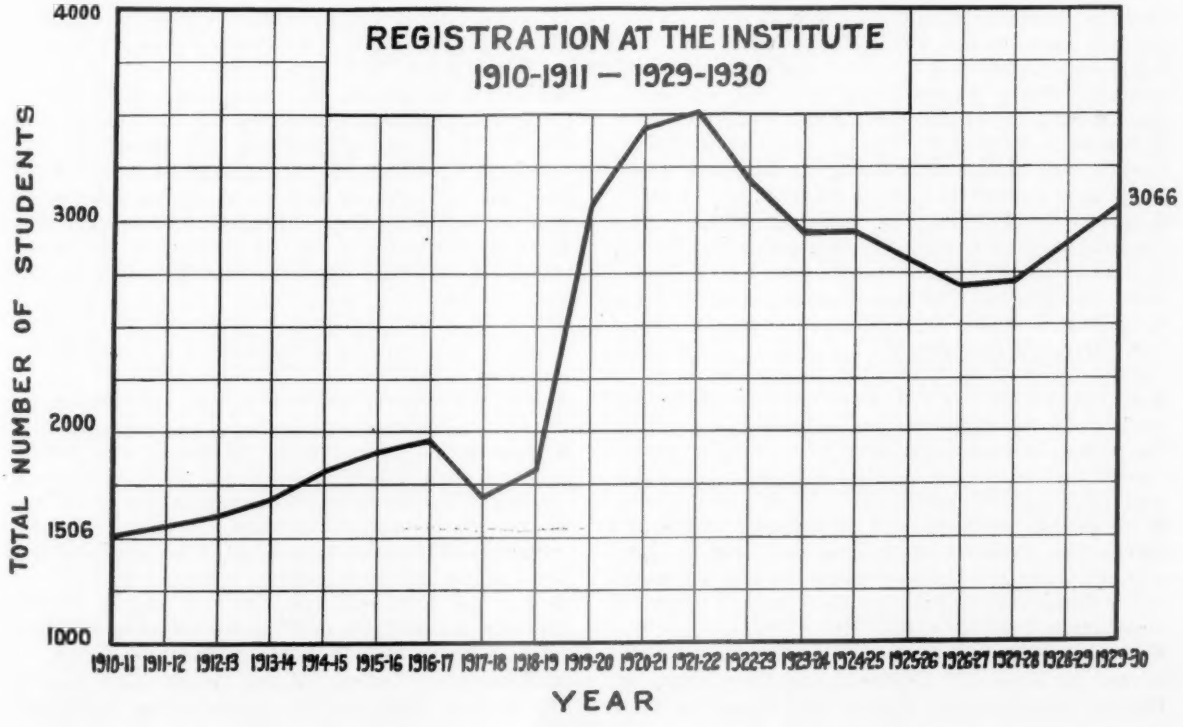
Clair E. Turner, '17, Professor of Biology and Public Health, and a pioneer in public school health work, spoke on the advantages and achievements of organized child health study, and supplemented his talk with the showing of a film produced by the Department of Biology and Public Health at the Institute in coöperation with the Eastman Kodak Company. This film, one of many, was designed for use in teaching physiology in public schools. These films are remarkable for their advanced technique and for the clarity with which they present their subject matter. The final speaker of the evening, Robert L. O'Brien, former editor of the Boston *Herald* spoke on "What 1930 Means to Us."

Tuition Increase

IN THE FALL of 1931 tuition at the Institute will be increased from $400 to $500 a year in accordance with a vote of the Corporation on Wednesday, January 8. This is the second time within three years that the tuition rate has been increased; in March, 1927, the Corporation voted an increase from $300 to $400 a year.

The increasing per capita cost of education and the need of higher salaries for the instructing staff prompted this latest change. Engineering education requires a greater expenditure than liberal arts training; last year the Institute expended more than $850 per student.

In 1881, when Technology was twenty-six years old, the tuition fee was $200 and it remained at that figure until 1906 when it was made $250. In 1919 the amount was raised to $300.



ADVERSARIA

Presided

DR. GEORGE K. BURGESS, '96, Director of the Bureau of Standards and Chairman of the National Research Council, over two sections of the World Engineering Congress in Tokio. He was the only American to receive Honorary Membership in the Society of Mechanical Engineers of Japan, and he made the address on the conferring of the Holley Medal to Baron Shiba.

Consulted

¶ JEROME C. HUNSAKER, '12, Vice-President of the Goodyear-Zeppelin Corporation, pronounced feasible facilities for mooring airships on top of the new Empire State Building which is sponsored by former-Governor Alfred E. Smith. He estimated that provision could be made for mooring a thousand-foot airship above the building.

Appointed

¶ JAMES F. NORRIS to be a director of the American Chemical Society for 1930 to 1932.

¶ EDWARD R. SCHWARTZ, '23, to be Assistant Professor of Textile Technology at the Institute.

¶ ELMER W. BRUGMANN, '24, to be Assistant Professor of Chemical Engineering and Assistant Director of the Research Laboratory of Applied Chemistry.

¶ LEROY F. MAREK, '28, to be Assistant Professor of Chemical Engineering and Assistant Director of the Research Laboratory of Applied Chemistry.

¶ FRANK J. OSBORNE, '12, to be a member of the Committee on Public Health Organization of the White House Conference on Child Health and Protection.

¶ ROBERT S. BURNAP, '16, lamp engineer at the Edison Lamp Works of the General Electric Company, to be Secretary of the Society of Motion Picture Engineers.

¶ IRVING B. MCDANIEL, '17, to be aide to Governor-General Dwight F. Davis, at present assigned to Cavite, P. I. From the Philippine Islands he will go to Japan, China, and Java, and then home through Suez and Europe.

¶ CHARLES H. REED, '20, to be Chairman of the Lacquer Institute, which comprises the manufacturers of seventy-five per cent of all the lacquer sold in this country.

¶ C. LAUREN MALTBY, '22, to be Secretary of the National Air Travelers Association, and also its statistician. The purpose of the Association will be to act as a clearing house for aviation information and to advance the personal safety and convenience of the air traveler and pilot.

¶ STANLEY G. H. FITCH, '00, of Patterson, Teele, and Dennis, Vice-President of the American Institute of Accountants, was an official representative of the Institute at the Fiftieth Anniversary of the Society of Chartered Accountants, held in Quebec.

¶ ARCHIBALD L. PARSONS, '97, to be Chief of the Bureau of Yards and Docks of the Navy, with the rank of Rear-Admiral, Corps of Civil Engineers, U. S. Navy, for a term of four years, beginning December 21, 1929. The appointment automatically makes Parsons the Chief of Civil Engineers, U. S. Navy during his incumbency.

¶ GEORGE A. HOOL, '05 to be Vice-President of the John W. Ferguson Company, engineers and builders in New York and Paterson, N. J.

Deaths

Since the last issue, reports have come to The Review of the decease of the following:

¶ A. WHITING WATRISS, '75, on October 22. He was a commercial photographer with the Decorators Supply Company in Chicago.

¶ WILFRED LEWIS, '75, suddenly at sea on December 29, as he was taking a trip around the world after the World Engineering Congress in Tokio. He was President of the Tabor Manufacturing Company and he had received several important medals for his work in construction and perfection of appliances connected with manufacturing. See page 203.

¶ EDWIN H. LINCOLN, '75, on December 8. He was a member of the firm of Aspinwall and Lincoln in Boston.

The Secretary of '77 has been zealous in ferreting out old records and reports the following deaths, not previously reported: DAVID H. AUSTIN, on May 27, 1877; EDWARD E. PIPER, on June 23, 1925; ARTHUR J. GOODMAN, on October 3, 1926; LYMAN W. SMITH, two or three years ago; ROBERT D. GEER, previous to 1916; CHANDLER MACOMBER, previous to 1880; HENRY TUDOR, on November 26, 1925; and WALLACE R. POND, in July, 1926.

¶ CHARLES B. PERKINS, '87, on December 16. He took a postgraduate course in Architecture at the Institute and attended the Beaux Arts in Paris. He practised architecture in Boston from the late '90's to his retirement in 1914. He had been an active member on the Boston Schoolhouse Commission. A longer notice will follow.

¶ FRANK GOODWILLIE, '89, on October 17. He was a member of the firm of Goodwillie and Moran, architects, in New York.

¶ SAMUEL B. SHELDON, '89, on November 22 in Duluth, Minn. He was President of the Minnesota Steel Company, following Judge Gary.

¶ FAY B. KENDALL, '93, on March 23. He was formerly a lawyer in Boston.

¶ FRANCIS A. J. FITZGERALD, '95, on October 28. He was an electrical engineer in Niagara Falls, and a loyal member of the Technology Club of that city.

¶ GENERAL DWIGHT E. AULTMAN, '95, on December 12. Although affiliated with the Class of '95, many '96 men knew of him and his association with the Army.

¶ WILLIAM LOHMEYER, JR., '17, on August 26. For disability received in action, he was retired as a Captain in the Army on May 25, 1920.

¶ ALBERT M. YOUNG, '21. No details have been received of his recent death as reported in the '20 Notes.

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ADVENTURES IN RADIATION

(Concluded from page 188)

consisting of numerous batteries, meters, vacuum tubes, and optical instruments, is enough to warm the heart of almost any man having even the slightest propensity for things scientific.

Many other experiments, past and present, could be added to the list, but a sufficient number have already been described to indicate the nature of the work which the students are trained to do. The field is constantly expanding so that within a short time the Radiation Measurements Laboratory will again have outgrown its quarters. Another moving day is anticipated.

BUILDING A GREAT CITY

(Continued from page 192)

The Public Garden, twenty-four acres in extent, lying immediately to the west of Boston Common was formerly a submerged area, a part of the Back Bay, the old shore line being along Charles Street which separates the Common and the Garden. The land occupied by the Garden, as well as by nearly the whole of the Back Bay district, was made by filling the bay and the mud flats, about the middle of the Nineteenth Century.

In 1875, after long agitation of the question, the State Legislature passed an act authorizing the appointment of a Board of Park Commissioners for the City of Boston with power to take lands for, and to construct, public parks. Within twenty years from the appointment of the board in 1875, Boston had acquired and constructed a comprehensive system of parks and connecting boulevards which, upon completion, were far superior to those of any other American city.

The Boston park system made such an impression upon other communities around Boston that the latter secured legislation, in 1892, under which the Governor appointed a temporary commission to serve one year to report upon the advisability of laying out ample open spaces for the use of the public of Boston and nearby communities, and to outline a comprehensive plan for laying out and maintaining such open spaces.

This Temporary Metropolitan Park Commission, in its report submitted in 1893, pointed out that the growth of rapid transit, both by steam railroads and electric railways, had made every municipality within ten miles of Boston a close suburb of that city. The city population was rapidly diffusing itself over this metropolitan area, so that the area had already become in reality one large community. South of the Charles River the City of Boston and some of the other communities were already provided with open air recreational spaces. Elsewhere, however, one found conditions to be quite different — miles of thickly settled territory with little provision for such open spaces and in many communities no lands available for recreational use. Socially this great district was one and its recreational needs should be met as a unified problem, otherwise its natural development would surely be hampered. *(Continued on page 212)*

The Rubicon

The Gallic wars over, Gaul reduced to a peaceful Roman province and his term as Proconsul about to expire, Julius Caesar had decisions to make. It was the bleak winter of 50-49 B.C. but Julius Caesar chafed in his Thirteenth Legion's camp at Ravenna, southernmost city of Cisalpine Gaul. Events at Rome disturbed him. The old triumvirate, Caesar, Pompey, Crassus, had ended with Crassus' death, and now world-conquering Pompey had Asia, Africa, Spain and Italy at his feet. Caesar, supreme only in Gaul, but counting on the devotion of his Legions, braced himself for an inevitable conflict. As TIME, had it been published on the Ides of January, 49 B.C., would have reported subsequent events:

... To Julius Caesar came travel-stained Tribunes Mark Antony and Quintus Cassius Longinus, bearing bad news: On January 7th, the Senate, intimidated by Pompey's partisans, had declared Caesar guilty of high treason if he did not at once resign his Proconsulship of Gaul, disband his legions. For seeking to exercise their traditional right of veto, they, Tribunes Antony and Cassius, had been hounded from Rome by Pompey's soldiery. As they blurted out their story, long-nosed Caesar listened quietly, smiled faintly. Then sharply, he issued orders to the Centurions of the Thirteenth Legion.

Soon foot soldiers in small groups set out for fateful Ariminum (30 miles away), first Roman city beyond the Gallic frontier. Caesar himself feasted and dined until mid-evening, then suddenly he left the banquet hall, leaped to a chariot, drove speedily southward, his cavalry thundering behind.

Soon he came to the banks of the little river Rubicon, hardly more than a stream. At the ford, Gaul-Governor Caesar paused until his horsemen caught up. Here was the frontier he might not legally cross—in arms, and accompanied by his legions. Caesar knew that five thousand of his foot soldiers were already well across the Rubicon, well on their way to Ariminum, but a touch of drama was necessary to weld his cavalrymen still closer to him, to nourish the fast-swelling Caesar legend. So, slowly, earnestly, he spoke: "My friends, if I pass not this river immediately, it will be for me the beginning of all misfortunes (a murmur from the ranks), and if I do pass it, I go to make a world of people miserable." (a cheer from the ranks). For an instant he hesitated, seemingly lost in thought, then suddenly drove his chariot through the shallow stream, crying in a deep voice "Let the die be cast!"...

Two hours later Caesar overtook his foot soldiers at Ariminum, and by sun-up invested the surrounding countryside. Soon fleeing peasants were carrying to Rome inspired rumors that great Caesar with *all* his Legions was coming to avenge himself on Pompeius Magnus. Rome gasped in horror, remembering all too vividly the butcheries of too-recent civil strife between Marians and Sullans....

So too, in succeeding issues, would TIME have reported how Caesar drove Pompey out of Rome, then, relentlessly, out of Italy; how after four years of bitter civil war throughout the Empire, Caesar returned to Rome triumphant, master of the civilized world—until assassinated six months later.

Cultivated Americans, impatient with cheap sensationalism and windy bias, turn increasingly to publications edited in the historical spirit. These publications, fair-dealing, vigorously impartial, devote themselves to the public weal in the sense that they report what they see, serve no masters, fear no groups.

TIME

The Weekly Newsmagazine

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ALLERTON

Chicago New York Cleveland

BUILDING A GREAT CITY

(Continued from page 210)

Two solutions of this problem were possible — one, consolidation of municipalities into a single political entity; the other, the development of recreational facilities under state authority. Consolidation was not practical, as the sentiment of the communities was generally for maintaining their political independence. State action, however, was deemed to be entirely practical. The commission pointed out that, of the world's large cities, London alone presented the problem that confronted Boston and its surrounding territory.

The legislature accepted the report of the Temporary Metropolitan Park Commission as the answer to the recreational problem of the metropolitan district, and in 1893 it passed the act creating the Metropolitan Park System and providing for the appointment of a permanent Metropolitan Park Commission.

In acquiring lands for park purposes for the Metropolitan District it was the intention to follow the practice already adopted by the City of Boston for its city park system, that is to aim to secure open spaces at once before communities became more thickly settled and to leave these open spaces more or less in their natural state until such time, if ever, as artificial development seemed desirable.

THE Metropolitan Sewerage, Water and Park districts are the three permanent and legally established districts created by legislative enactment, for which public improvements have been constructed for the common benefit of the communities concerned. Other metropolitan activities have been, and are being, carried out under authority of state legislation.

The improvement of the Charles River Basin, formerly a tidal estuary with offensive mud flats, carried out about twenty-five years ago by a special commission under authority of state legislation, is the chief example of a special metropolitan constructional activity.

In the matter of rapid transit in the territory in and around Boston, the State has exercised authority of metropolitan character. This territory is served by two transit systems, the Boston Elevated Railway Company and the Eastern Massachusetts Street Railway Company. Prior to the World War these two companies had found it increasingly difficult to make both ends meet under the fare restrictions imposed. When the War came, bringing in its train the rapid increase in the general scale of prices, the situation became increasingly acute and, by 1918, both companies were faced with the alternative of securing increased revenue or going into bankruptcy. Adequate transportation was a matter of deep concern to the communities depending upon these two companies for service. Public ownership was not favored. Instead of public ownership, the Legislature of 1918 passed two Public Control Acts, one applicable to the Boston Elevated system, the other to the Eastern Massachusetts. For each there was created a Board of Trustees, appointed by the Governor, which took over the control and the operation of the system as a matter of public necessity. Former fare restrictions were abolished. Each Board of Trustees was directed to operate its system at cost; and was given power to establish rates of fare sufficient to pay the expense of operation *(Continued on page 214)*

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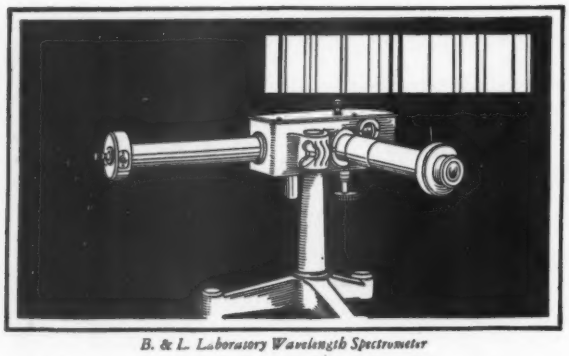

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BUILDING A GREAT CITY

(Continued from page 212)

and upkeep, to meet interest and retirement charges of bonds and preferred stock, and also to pay dividends on common stock of the company at rates fixed by the Public Control Act. Thus these two transportation systems were taken out of the hands of the stockholders and put under the control of public officials where the control remains today, although the question is now under discussion as to what the future arrangement shall be. Thus far, public control has been of distinct benefit to the metropolitan district and has been the means of saving the situation which had become most critical in 1918.

The Metropolitan Planning Division was established by legislation passed in 1923. Although a division within the Metropolitan District Commission, it is broadly representative and, of the seven commissioners in charge, three are appointed at large by the Governor and the others are official representatives of the State Departments of Public Works and of Public Utilities, the Metropolitan District Commission and the Transit Department of the City of Boston. The Metropolitan Planning Division is charged primarily with the duty of investigating and making recommendations as to transportation service and facilities within the metropolitan district. In no sense does it supplant local planning agencies, nor does it deal with projects exclusively local in character; it aims to secure coördination upon broader matters affecting the district as a whole.

The United States Government was the first to give official recognition to the metropolitan character of the district in and around Boston. Even before the State established the first metropolitan district (the Metropolitan Sewerage District, established in 1889) the United States Post Office Department had created a metropolitan postal district by consolidation of the post offices of surrounding cities and towns with that of the City of Boston itself. Boston has the distinction of having had the first post office in the American colonies. This was established by order of the General Court on November 5, 1639; its location being indicated by a tablet now in the doorway of the Boston *Globe* Building, 244 Washington Street. Today, the Boston Postal District is the largest in area of any postal district in the United States; the present postmaster is Col. Charles R. Gow, Professor of Humanics at the Institute.

The State of Massachusetts has loaned its credit in the first instance and has issued the bonds necessary to meet the cost of metropolitan developments. In no case, however, have these developments been treated as state-wide undertakings, nor has the work of construction been carried out by established state departments; instead, the State has created a special agency to handle each separate metropolitan problem. Altogether, the State has issued considerably more than $200,000,000 of bonds for metropolitan improvements. The cost of maintaining and operating these improvements is met by legislative appropriation from the State Treasury. By these transactions, the State is not out of pocket, however, as interest and retirement of bonds and the cost of maintenance and operation are reimbursed to the State by direct tax on the municipalities *(Concluded on page 216)*

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BUILDING A GREAT CITY

(Concluded from page 214)

of each of the several metropolitan districts. The method of apportionment of this tax is variable but is usually based either on the population or on the assessed valuation, or both, of the communities benefited.

MODERNISTIC ARCHITECTURE

(Concluded from page 196)

When we think of *modern* architecture, we picture skyscrapers, office buildings, banks, theatres, which have departed somewhat from the old traditional elements of design on account of twentieth century requirements. The modernist's conception of modern architecture is the cubistic, box-like, and, in general, ugly buildings of which there are so many examples in modern Europe. The more gradual diverters from the old appear to be following the more logical path. De Klerk in Holland is truly modern (see page 196) yet his designs have not the cold austerity, the bold falsity, to cast aside entirely the value of pleasing proportion, of adequate consideration to the need of beauty fundamentals. That it is not necessary to go to extremes, and yet be modern, is shown by Ralph T. Walker,'11, and a few others in this country who have made some unusually fine designs in the modern spirit.

Contrive to retain a happy relation between the whole and all of its parts. Exclude none of the virtues of beauty. Be rational, be logical. Do not be extreme. Proceed cautiously, sure-footedly.

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THE TABULAR VIEW

AMERICA'S non-fecundity in pure science is a myth that The Review delights in dispelling. It implodes immediately when subjected to the array of facts presented by JOSEPH MAYER in his article "Can Americans Be Scientists?" A survey of Dr. Mayer's versatile accomplishments recalls the lament of Palmerston that he wished he could be as sure of one thing as Macaulay was of everything. Dr. Mayer is now Head of the Department of Economics and Sociology at Tufts College and has taught and lectured on a bewildering variety of subjects: social ethics, mathematics, physics, mechanics, economics, world peace. He has a number of books to his credit, including "The Seven Seals of Science." Adjuring any facetious interpretation, in admiration of him one might cause him to repeat:

"My name is Benjamin Jowett,
I'm master of Balliol College
Whatever is known, I know it
And what I don't know isn't knowledge."

DR. JAMES A. TOBEY, '15, sanitarian, was introduced to Review readers in November with his article, "Forestalling Death." He contributes again this month, "Business Discovers Health," another article on health promotion. At the present time he is Director of the Department of Health Service of The Borden Company. He contributes to many magazines, and one book of his, "The Most Nearly Perfect Food," is reviewed on page 251. He reports another book ready for the press. His activities are not confined to the science of public health work for he is also a member of the Bar. ¶ ERWIN H. SCHELL is Professor of Business Management at the Institute. He has kept in constant contact with all graduates in the Course of Engineering Administration through his "Five Hundreds Club." Consequently, he has collected a great body of data of the activities of technical graduates. He is the author of "A Million Dollar Lecture" and of "The Technique of Executive Control." By way of footnote it might be added that he is also a pianist of parts.

WILLIAM EMERSON, who reviews CHARLES S. WHITNEY's book on bridges, is Head of the Institute's Department of Architecture. After studying at Columbia and the École des Beaux Arts, he practised architecture until he was called to the Institute to succeed RALPH ADAMS CRAM. He is a Chevalier of the Legion of Honor and author of "Old Bridges of France." ¶ The reviewer of Dr. Tobey's book on milk is SAMUEL C. PRESCOTT, '94, Head of the Institute's Department of Biology and Public Health. He has had wide experience both in teaching and as a consultant in industrial microbiology. ¶ JOHN J. ROWLANDS is one of the Review's Contributing Editors and was the author of "Science and the Front Page" which appeared in December. ¶ GEORGE W. ADAMS is an instructor in the Institute's Department of English and History.

(Concluded on page 230)

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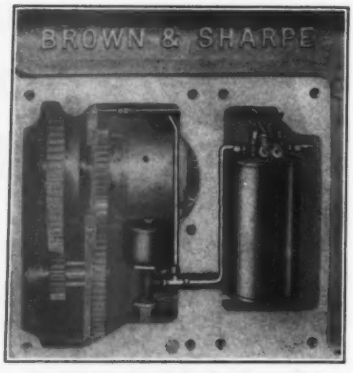

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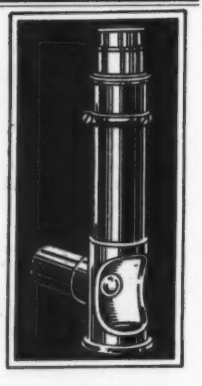

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THE TABULAR VIEW

(Continued from page 229)

REGIONAL and town planning and the art of making our cities more livable have received much emphasis in recent numbers of The Review and it has much more material yet to present on the subject. Several letters have been received in comment. ROBERT ANDERSON POPE, '02, writes of Thomas E. Tallmadge's article in the December issue: "It was thrilling, orderly, historic, responsible, and far sighted." Mr. Pope referred us to interesting material which he has published on town planning. ¶ CHARLES L. KASSON, '06, has forwarded us some of his own suggestions for the development of our cities. Says he, "The engineering fundamentals of the great city of the future are so simple, why not begin to plan now:

1. Inner electric zone.

(a) The minimum of exhaust gas with its dangerous carbon monoxide content.

2. Coördinated transportation facilities.

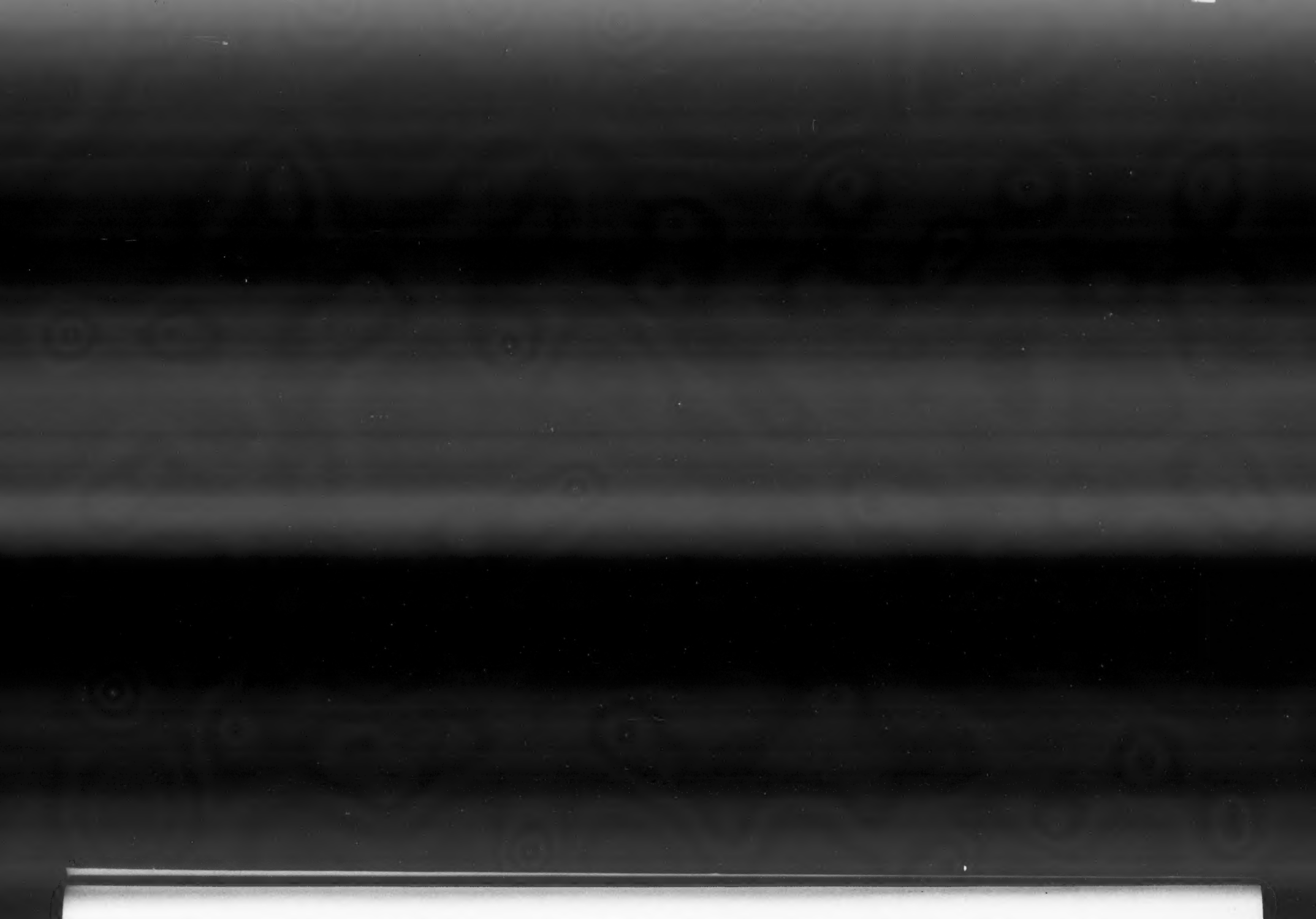
3. Underground high speed radial and belt electric railways.

4. Underground pipe and wire tunnels. . . .

5. Surface gas and electric busses.

6. Elevated pedestrian deck. . . .

7. Three entrances to stores from subways, surface streets and elevated ped-decks."

THE REVIEW'S continued enlargement and — shall we say it? — editorial enrichment are meeting with unprecedented success. The print order for each successive issue grows larger and larger. STUART CHASE's ('10) article in the November issue was selected as one of the ten leading articles published in America during that month and in another selection was chosen as one of the thirty best articles. In addition it has been translated into German. DR. TOBEY's "Forestalling Death" (*vide supra*) was reprinted in two other magazines, as was DR. ARTHUR D. LITTLE's ('85) "Research and Labor." JOHN J. ROWLAND's "Science and the Front Page," published in December, has been widely quoted and DR. NORBERT WIENER's "Mathematics and Art," published in January, has been reprinted. ¶ These recognitions are plainly reflected in a growing circulation: The Review's customers seem to want and enjoy it and their interest is more than a passing fancy, for they show a charming disposition to continue as permanent subscribers. Future issues are to be in size larger and in content equally important and interesting. Articles are already planned discussing the sick textile industry, the more advanced ideas of the French city planners, the collecting of prints, the study and control of lightning, the scientific method applied to the study of history and the life of Count Rumford.

ON THE COVER of this issue is reproduced "The Propylæa" by PROFESSOR HAROLD B. WARREN of the Harvard School of Architecture.